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MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

THE BOTANICAL SOCIETY OF AMERICA

A UNION OF THE BOTANICAL SOCIETY OF AMERICA, THE SOCIETY FOR PLANT MORPHOLOGY AND PHYSIOLOGY, AND THE AMERICAN MYCOLOGICAL SOCIETY

THE first meeting of the united societies (the thirteenth annual meeting of the Botanical Society of America) was opened at Columbia University, New York City, December 27, 1906, under the presidency of Professor F. S. Earle. About sixty members were in attendance at the meeting, which was a most interesting one. The success of the meeting was in no small degree due to the thoughtful hospitality of the officers of the New York Botanical Garden, the Botanical Department of Columbia University and the Torrey Botanical Club.

The officers elected were:

President—Professor G. F. Atkinson, Cornell University.

Vice-President—Director N. L. Britton, New York Botanical Garden.

Treasurer—Dr. Arthur Hallock, New York Botanical Garden.

Secretary—Professor D. S. Johnson, Johns Hopkins University.

Member of Council—Professor H. M. Richards, Columbia University.

Seventeen associate members were elected and the total membership was increased to 135.

The society voted to hold its next annual meeting in conjunction with the American Association for the Advancement of Science.

Sessions for the reading of papers were

held at Columbia University on December 27 and 31, and at the museum of the New York Botanical Garden on the morning of December 29. At the latter meeting the presidential address—'The Organization of Certain Cœnobic Plants'—was delivered by Past President R. A. Harper. After the meeting a luncheon was served in the laboratories of the garden to the members of the society and Section G of the American Association for the Advancement of Science.

Abstracts of the technical papers read follow:

Figures Produced by Protoplasmic Streaming in Fungi and Slime Moulds: Professor R. A. Harper, University of Wisconsin.

The Origin of Air-Chambers in Liverworts: Professor C. R. Barnes and Dr. W. J. G. Land, University of Chicago.

Intercellular spaces are formed in higher plants by the splitting of cell walls and the separation of the cells by their unequal growth and turgor. The air-chambers of liverworts, especially of Marchiantiales, are so peculiar in form that some peculiar mode of origin was looked for. Hofmeister ascribed their formation in *Marchantia* (1862) to the detachment of the epidermis and its lifting by the plates of cells which form the side walls. This view made the air-chamber only a special form of intercellular space. But Leitgeb controverted this interpretation (1880), and his view has been universally accepted for a quarter of a century. He ascribes the origin to a slower growth of the cells at the point where four to six lateral walls meet, and the consequent formation of a pit, which becomes overgrown by adjacent cells as it deepens. He emphasizes the statement that the lowest point of the pit is the original surface, and homologizes the air chambers strictly with the pits, nearly closed at mouth, in which many sex organs are sunk.

The authors show that Hofmeister probably did not see the real origin of the air-chambers, but only later stages in their development; that Leitgeb's observations, correct as far as his descriptions and figures show, were misinterpreted by him, and do not account for the course of development described; and further, his few observations of the real origin were actually distorted (according to his own confession) to fit his theory of the homology of the air chambers with sex-organ pit.

Evidence can now be adduced, by means of the superior technique available, which shows beyond doubt that the air chamber appears first as an internal intercellular space, usually within two segments from the apical cell. This space increases in size, breaks out to the surface (rarely being met by inward splitting from the surface), and sometimes deepens by further splitting inward from the original point of origin. The remainder of the development is due to growth in all dimensions, but chiefly parallel to the surface. Thus the floor of the air-chamber, instead of arising from the original surface and being roofed over by adjacent cells, as is universally taught, is an internal surface, formed, as in other plants, by splitting due to unequal turgor and growth. Instead of being homologous with the sex-organ pits the air-chambers are strictly homologous with intercellular spaces generally.

Fertilization and Embryogeny in Ephedra Trifurca: Dr. W. J. G. Land, University of Chicago.

In *Ephedra trifurca* Torr. the pollen chamber extends to the female gametophyte, and the necks of the archegonia are freely exposed. The pollen grains rest in the bottom of the pollen chamber in contact with the female gametophyte.

Cultures of the male gametophyte in saccharose solutions gave the following results: The exine is ruptured and its contents completely freed. The body cell gives rise to two elliptical male cells equal in size and optical appearance. Later the pollen tube appears and continues to elongate for about twenty-four hours. Fertilization is possible within ten hours after pollination. Four days having elapsed between the collecting of material at Mesilla, N. M., and its fixation at the University of Chicago, it was not possible to observe stages in the progress of the pollen tube to the egg.

The fertilized egg gives rise to eight free nuclei more or less unequal in size. The number of cells which reach the suspensor stage varies from two to five. Immediately after the egg is fertilized the walls of the jacket cells disappear and their contents are mixed with the cytoplasm of the egg.

The chromatin of the second male cell and also that of the jacket cells seems to be responsible for a mass of minute ephemeral cells. Possibly this mass of small cells may be looked upon as at least suggesting how the endosperm of angiosperms may have originated.

The functioning embryonal cells become spherical. Two free nuclei are formed in each embryonal cell and soon afterward the suspensor appears. After the suspensor reaches a considerable length one of the free nuclei passes into it and downward to the tip. Immediately above the latter nucleus a ring of cleavage appears in the cytoplasm, beginning at the suspensor wall and gradually continuing inward until the cytoplasm of the embryo is separated from that of the suspensor. A wall is then laid down and the separation is complete. The suspensor nucleus passes into the suspensor and takes a position near the embryo, where it soon disintegrates. The walls of the embryo are laid down in the usual manner on the cell plate.

Under favorable conditions the development of the embryo is continuous and the young plant breaks out of the seed before the strobilus is shed. From the time the strobili can be recognized until the appearance of the young plant about six months elapses, being the shortest time yet reported for any gymnosperm.

Dioon and Ceratozamia: Dr. CHAS. J. CHAMBERLAIN, University of Chicago.

An account was given of a second trip made to Mexico for the study of *Dioon* and *Ceratozamia,* by the aid of a grant from the Botanical Society of America.

Fruiting specimens of *Dioon spinulosum* were not found during the trip, but material has been secured. There are frequently more than two ovules on a sporophyll, sometimes as many as five; the seeds are larger than those of any known cycad except *Cycas* itself. The ovulate cones are reported to be lateral.

Ceratozamia was found in considerable abundance. The motile sperms were studied in the living condition and material has been secured for a study of most phases in the life history. The seeds are small and are shed soon after fertilization, so that there is a continuous development, without any resting period, from fertilization up to the leafy plant.

A series of photographs were obtained, of which lantern slides were shown.

The Genus Pleurococcus Culturally Considered: Dr. G. T. MOORE, Bureau of Plant Industry.

The Early Growth of Monostroma and Enteromorpha: Dr. TRACY E. HAZEN, Barnard College.

Our knowledge of early stages of growth in the family Ulvaceæ is comparatively meager. In the genus *Monostroma,* the

only complete account is that of Reinke on *M. bullosum,* a fresh-water species showing the nearest approach to *Tetraspora,* and not infrequently included in the latter genus. More extended investigation of the marine species is desirable.

In a *Monostroma* which is rather abundant on rocks and woodwork in harbors about New York (probably a small form of *M. crepidinum* Farlow) a fairly complete series of young plants has been obtained. The earliest stage is not a hollow sphere as described by Reinke for *M. bullosum,* but a short, erect filament somewhat resembling that of *Ulothrix.* Soon, by longitudinal divisions in its upper cells, this filament becomes club-shaped, and by further divisions, followed by separation of the cells, balloon-shaped. The lower cells divide little, but elongate to form the characteristic rhizoidal cells found in most Ulvaceæ. The balloon-shaped portion splits open at the top by irregular rents, to form the lobed, expanded thallus characteristic of the mature plants.

In two species of *Enteromorpha* found with the *Monostroma,* I have discovered a very similar early growth; beginning with the formation of a shorter filament, the thallus takes on a long cylindrical, club-shaped form, which becomes tubular directly, and not after the formation and subsequent splitting of a flat, two-layered sheet, as usually described for this genus.

The early growth of *Ulva* is also said to be filamentous. This similarity of young stages shown by these three genera appears to indicate a rather close relationship to the Ulotrichaceæ, so that the separation by recent writers of the Ulvaceæ to a distinct order may not be sufficiently warranted.

Spore Formation in Derbesia: Dr. B. M. Davis, Cambridge, Mass.

Derbesia, whose general morphology and cytology is that of the Siphonales, is unlike the other members of this group in having very large zoospores, very unlike the small biciliate zoospores and motile gametes characteristic of this group of algæ, since each is provided with a large circle of cilia. The zoospores are developed in relatively small numbers (50–200), in sporangia which contain many thousands of nuclei when first formed upon the parent filaments.

A process of nuclear differentiation sets in shortly after the sporangia are developed. Some of the nuclei increase to four to six times their original size and finally become the nuclei of the zoospores. All others degenerate, decreasing in size, losing their chromatin content and finally breaking down in the cytoplasm. The large surviving nuclei are rather uniformly distributed throughout the cytoplasm, but are not associated with any cytoplasmic centers such as cœnocentra.

The spores are formed by cleavage furrows which enter the protoplasm from the periphery and by branching in different planes cut out the protoplasm into approximately equal masses around the large nuclei. The nuclei at this stage lie in the centers of the spore origins and from them many delicate fibrils radiate into the cytoplasm among the plastids. These radiating cytoplasmic fibrils have small granules at their bases lying against the nuclear membrane.

The nucleus of each spore origin comes to lie near the periphery, the radiating fibrils on that side (about one third of the total number) becoming connected with the plasma membrane of the spore. The fibrils also take a funnel-shaped arrangement from the nucleus outward. The granules at the bases of these fibrils pass along them to the periphery and finally lie in a circle about twice the size of the nucleus, just beneath the plasma membrane.

The granules then fuse together to form a firm, deeply staining, homogeneous ring which is the blepharoplast, and lies very close to the plasma membrane but is not a part of it. The fibrils which connect the blepharoplast with the nucleus disappear and the nucleus somewhat later passes back to the center of the spore. The blepharoplast now splits into two rings, one directly below the other. Cilia grow out from the lower ring forming a circle around the zoospore, which is about one half the diameter of the latter.

Sexuality in the Mucors: Dr. A. F. BLAKESLEE, Harvard University.

The *Mucors* are divided into two groups termed respectively homothallic and heterothallic. In the homothallic group, zygospores are developed from the same thallus and can be obtained from the sowing of a single spore. In the heterothallic group, which comprises a large majority of the species, zygospores are developed from branches which necessarily belong to thalli diverse in character and can never be obtained from the sowing of a single spore. Every heterothallic species is therefore an aggregate of two distinct sexual strains through the interaction of which zygospore production is brought about.

In the heterothallic species *Mucor Mucedo,* the segregation of sex is completed at or before the germination of the zygospore and all the spores in a given germ sporangium are of the same strain, either male or female.

In the germination of the zygospores of the heterothallic species *Phycomyces,* a segregation of sex takes place at the formation of spores in the germ sporangium which contains both male and female spores. The liverwort *Marchantia* polymorpha has been found to correspond to this latter type of zygote germination and male and female spores are contained in a single capsule.

Cultures were exhibited showing dark lines of zygospores between male and female strains of the same species and white lines of imperfect hybrids between male and female strains of different species. Microscopic preparations of zygospores of various species were also exhibited.

The Teaching of the Subject of Respiration: Professor CHARLES H. SHAW, Ursinus College.

The word respiration is used in several different senses. A confusion of ideas also exists. Except in connection with highly differentiated animals, the term respiration must signify either a gaseous interchange, or a metabolic process of energy release. The former definition lends itself to clear statement, is readily developed from experiments, and refers to a process which is really a non vital one. The latter, though not so easy to teach, refers to the essential process. For several reasons it is thought that the latter will stand. At all events the process of energy release must occupy the central place in teaching.

It is sometimes said that in respiration $CO_2/O_2 = 1$, and also that all protoplasm must obtain oxygen somehow all the time. Such formal ideas will not square either with the published facts upon the subject nor with class-room experiments.

The subject is worthy of a more adequate treatment in general courses. Eudiometers over mercury with the seeds held up by glass wool are one favorable form of apparatus for demonstrating.

Relative Transpiration in Cacti: Dr. BURTON EDWARD LIVINGSTON, Desert Botanical Laboratory.

After a preliminary discussion of the meaning of relative transpiration, *i. e.,* the ratio of the increment of water-loss from the plant for any time interval to the cor-

responding increment of loss from an evaporimeter for the same interval, the paper proceeds to present a new fact in regard to the regulation of transpiration. While ordinary leafy plants in some way retard water-loss during the hours of darkness and remove the retarding influence during those of light, the cacti, at least as far as the study has gone, act in a manner exactly opposite, applying the retarding influence during the daylight hours and removing it during those of darkness. Thus, for a given transpiring surface, leafy plants lose water in the daytime more nearly at the rate of the same area of free water surface than they do at night, and cacti more nearly approach the evaporation rate from a water surface during the night than in the daytime. Data as to the nature of the mechanism by which either group of plants accomplish their regulation of water-loss is as yet entirely lacking, since Lloyd, in a paper about to be published, has thrown great doubt on the usually accepted idea that this regulation is mainly accomplished through stomatal movements.

The Water-Storing Tubers of Nephrolepis cordifolia: Professor J. W. Harshberger, University of Pennsylvania.

Nephrolepis cordifolia is a fern occasionally met in cultivation. When grown in the open it forms tubers the size of a walnut. These are developed at the end of lateral underground branches covered with flat, scale-like ramentæ which extend also to the surface of the tuber. The tubers do not store starch and other reserve foods, as an external examination of the tubers might lead one to expect, but the large, rounded, parenchyma cells are turgescent with a clear watery fluid, evidently stored against the time of drought, as the fern is usually epiphytic in habit. When these tubers are dried, they dry until they almost entirely shrivel up.

A New Native Host for Pearblight: M. B. Waite, Bureau of Plant Industry.

The pearblight bacillus, *B. amylovorus,* is undoubtedly a native parasite on the American indigenous species of Pomaceæ; it occurs nowhere else in the world and is quite commonly found on the wild crab-apples and hawthorns of the eastern United States.

When pears and apples and other pomaceous fruits were introduced into this country it promptly attacked them. It is quite easy to find new hosts on cultivated species of the Pomaceæ, as almost everything belonging to this family when grown within the territory affected is likely to be attacked. Some of these Pomaceæ look very unlike our ordinary pears and apples, but, nevertheless, may be subject to this disease, *e. g.,* the evergreen *Eriobotrys Japonica* is attacked by this disease very commonly in Florida and Georgia, and recently has been found affected in California. The arid plains and deserts and the Rocky Mountain region appear to have formed an insurmountable barrier, determining the western limits of the pearblight germ. Within the last few years, however, doubtless through human agencies, the pearblight bacillus has jumped, first to Colorado, Utah, Idaho, etc., and finally over the deserts and the Sierras into California. It is now attacking with unusual virulence the pear orchards of that state.

Few native Pomaceæ occur in California in the vicinity of the pear orchards. The beautiful, red-berried, California holly, *Heteromeles arbutifolia* Roem., is, however, quite common in the foot-hills of the Sierras, in the coast ranges, and comes down into the fruit regions. This shrub with its thick evergreen leaves looks very much unlike a pomaceous fruit, but was

carefully watched for a year as a host for pearblight. After having practically given this up, however, in March, 1906, I found a striking specimen, badly attacked, at Vacaville. It had been affected on the blossoms the summer before and several of the twigs contained the living bacilli, they having been carried over the winter. It has since been found at Colusa and several other points in California.

The Causes of Dwarfing in Alpine Plants: Professor FREDERIC E. CLEMENTS, University of Nebraska.

Much attention has been given during the past eight years to the determination and measurement of the factors that determine alpine dwarfing in the Pike's Peak region of the Rocky Mountains. The work was begun with Bonnier's conclusions that the factors in dwarfing are stronger light, drier air and lower temperature, as working hypotheses. The behavior of many alpine polydemics which showed dwarf and normal forms at the same altitude, sometimes within a few feet of each other, indicated that light plays little or no part. Repeated and usually simultaneous measurements of light intensity were made in 1903, 1904, 1905 and 1906 at 1,900 m., 2,600 m. and 3,800 m. Midday readings at the three altitudes gave a value of 1 (comparative standard): in a few cases only, the intensity at 3,800 m. was 1.1 and 1.2 It is a well-known fact that the relative humidity increases with the altitude. As a rule, the relative humidity is 5–10 per cent. higher at 3,800 m. than at 2,600 m. and 15–20 per cent. higher than at 1,900 m. The variation is sometimes great, however, both simple and automatic readings giving now and then a lower humidity at the highest altitude. While humidity is not a factor in dwarfing, the reduced air pressure leads to increased transpiration, as demonstrated both by batteries of potometers and by water surfaces. The thermograph records of several years all agree in showing a great and regular decrease in temperature as the altitude increases. The decrease is about 1 1/3° for each 1,000 m., or an average difference of 25° F. between 1,900 m. and 3,800 m. The difference in the length of the season is correspondingly marked. The season is four and one half to five months at Manitou (1,900 m.) and two months on Mount Garfield (3,800 m.).

Of the factors stated by Bonnier, stronger light and drier air are not true of the region studied, and of course can play no part in dwarfing. Water content is the most important and universal factor, though its action is not at all restricted to alpine regions. Low temperature and shortness of season together stand next in importance, and even the third factor, reduced pressure, has a pronounced influence.

The Origin of New Forms by Adaptation: Professor FREDERIC E. CLEMENTS, University of Nebraska.

For purposes of experimental evolution, a careful census has been kept at Minnehaha of species that are undergoing modification. This not only gave much insight into the methods to be employed in producing new forms experimentally, but, for the region studied at least, it gave decisive evidence upon the relative importance of the four methods of origin, namely, variation, adaptation, mutation and hybridation. During seven years, but one genus, *Machæranthera,* showed sufficient variation to suggest that new forms might be arising from it in the manner assumed by Darwin. More than one hundred species have been recorded and studied in which new forms are arising by adaptation to new or changed habitats. Many of these ecads have been described

by systematic botanists as new species. With the exception of an occasional monstrous growth, the only mutants observed have been the albino forms of red- and blue-flowered species. Of these nearly thirty have been found. In the lack of experiment, no certain hybrids have been found. With the exception of the oak and the willow, however, no plants occur which furnish any suggestion of hybridation. In the region studied, accordingly, adaptation is by far the most frequent method of origin, mutation stands next, hybridation is rare if present, while origin by variation, *i. e.*, the indefinite variability of Darwin, is extremely uncertain.

A Study of Disease Resistance in Watermelons: W. A. Orton, U. S. Department of Agriculture.

A paper presenting the results of work on watermelon wilt (*Neocosmospora vasinfecta* var. *nivea* Erw. Sm.). A disease widely distributed from Maryland to Florida and Alabama, and occurring also in Iowa, Oklahoma, California and Oregon. The fungus enters through the small roots and plugs the vascular system, causing the sudden wilting and death of the plant. It can pass its whole existence as a saprophyte, and does remain in soil and in farmyard manure piles for ten years or more, yet it is an active parasite of the watermelon, attacking plants growing under most favorable conditions. It is not a damping-off fungus, nor a wound parasite, but is highly specialized as to host plants, attacking only watermelons, while other forms morphologically indistinguishable occur in the same area as specialized parasites of cotton and cowpea.

It is believed that this specialization accounts for the successful production of resistant strains, and that similar results would be more difficult of attainment in the case of diseases caused by fungi capable of attacking several hosts.

None of more than a hundred American and Russian varieties of melons tested proved resistant. The inedible citron or stock melon appeared to be immune, and was crossed with the watermelon in the hope of obtaining a resistant hybrid. A resistant strain of good quality developed in the third generation from this cross, and has become practically fixed after three years cultivation in isolated fields.

The Problems of Vegetable Teratology: Dr. J. A. Harris, Missouri Botanical Garden.

The Significance of Latency: Dr. George H. Shull, Carnegie Institution.

Paper to be published in full in Science.

The Organization of the Ecological Investigation of the Physiological Life Histories of Plants: Professor W. F. Ganong, Smith College.

The paper calls attention to the changing conception of ecology, which is ceasing to be a search for utilities and is becoming an analysis of meanings. While in broad, general, or generic features, adaptation in the old causative or historical sense does exist, in details of structure and habit it is rare if not wanting, and most so-called adaptation is simply coincidence or toleration. In physiognomic ecology, therefore, the best working hypothesis is the assumption that the plant is an aggregate of physical needs which match or overlap the physical conditions presented by the environment, while the completeness of the overlapping determines the perfection of the 'adaptation.' The study of the physics of environments has made much greater progress than the study of the physical demands of plants, and the latter now offers the most important and attractive field for ecological investigation. The paper then

discusses the methods of such study, and a classification of the physiological processes for purposes of investigation, through the four critical periods of the plant's life history, germination, orientation of seedling, spread of adult, and fruiting or sporification.

The Vegetation of the Blue Mountains of Jamaica: Dr. FORREST SHREVE, Woman's College, Baltimore.

The Blue Mountains of Jamaica above 5,000 feet altitude in the neighborhood of Cinchona, the Tropical Station of the New York Botanical Garden, are covered by evergreen broad-leaved forest. Floristically the area is related to the surrounding tropical lowlands and to Eastern North America. In vegetative characteristics the forest likewise shows a blending of tropical and temperate features. The climate is one of much rainfall and high humidity. Alpine influences are but weakly operative at the highest altitudes. Local differences in the vegetation can be correlated with the topography and its determination of several of the physical factors. Bryophytes and Pteridophytes, as well as epiphytes, are abundant. There is a marked difference in humidity, light, wind and other factors between the forest floor and the forest canopy, with a corresponding contrast between the hygrophilous character of the terrestrial herbaceous vegetation and lower epiphytes, and the xerophilous character of the higher epiphytes and the foliage of the trees. The winter is relatively a season of rest in leafing and flowering, the spring and summer the seasons of greatest activity. Growth of leaves and shoots is extremely slow even in the most rapid growing forms. Transpiration is high under favorable conditions, but shows a high degree of sensitiveness to changes in temperature and humidity, and under the climatic conditions commonly prevailing is very low.

Cultures of Uredineæ in 1906: Professor J. C. ARTHUR, Purdue University.

The experimental study in the life history of various species of plant-rusts, of which this paper is a report, has been in progress during the last eight years. It embraces rusts of economic importance, and others as well. The most notable result of the present year was with flax rust, which is very destructive in the flax fields of the northwest. It was found that this rust, unlike most of its near relatives, produces all its stages upon the flax plant, and that infection comes from the old straw and stubbles that have laid out of doors through the winter. The common rust on *Juncus tenuis* was found to be connected with the *Æcidium* on *Silphium*, and the *Uromyces* on *Scirpus fluviatilis*, with the *Æcidium* on *Cicuta maculata*. Considerable advance was made in separating the *Carex* rusts; and a number of *Leptopuccinia* were also grown. The work was aided by a grant from the society, and was in charge of Dr. E. W. Olive.

Peridermium acicolum the Æcial Stage of Coleosporium Solidaginis: Dr. G. P. CLINTON, Connecticut Agricultural Experiment Station.

Peridermium acicolum was found abundant on *Pinus rigida* at South Manchester, Conn., during the spring of 1906. It has been found in four different places in Connecticut—but has been reported only four or five times outside of the state, its distribution so far being confined to a small area extending from Massachusetts to New Jersey. After considering the synonomy in detail, the writer follows Arthur and Kern in calling the rust *Peridermium acicolum* (Und. & Earle). From observations made at South Manchester, verified

by an infection experiment, this fungus was shown to be the æcial stage of *Coleosporium Solidaginis* (Schw.) Thm., which is common throughout the United States on goldenrod and asters. This conclusion is based upon the following points: (1) No other suspicious rust followed the attack of the *Peridermium*. (2) The *Coleosporium* (both II. and III.) occurred abundantly on *Solidago rugosa* under trees having the *Peridermium* but not under trees free from it and slightly removed. Instances were found where infected pine leaves interlocked with plants of *Solidago* and in these cases the leaves of the *Solidago* were badly peppered with the uredinial sori of the *Coleosporium*. (3) The time sequence of the two rusts was just as it should be if they were related. (4) An indoor infection experiment with spores of the *Peridermium* on a plant of *Solidago rugosa* was successful in producing the *Coleosporium*.

Culture Studies on the Polymorphism of Basidiomycetes: Dr. Geo. R. Lyman, Dartmouth College.

The life histories of about seventy-five species of Thelephoraceæ, Hydnaceæ and Polyporaceæ were studied in pure cultures with especial reference to the occurrence of secondary methods of reproduction. About 40 per cent. of the species studied showed polymorphism of some form.

Oidia were found in fully one half of the species of Polyporaceæ studied, but not in the other two families. Chlamydospores of the ordinary type were found upon the mycelia in all three families and in about one fifth of the species. Secondary methods of reproduction of a higher order were found in six species as follows:

1. *Michenera Artocreas* B. & C. was shown to be the imperfect form of *Corticium subgiganteum* Berk. The spores of *Michenera* are highly specialized chlamydospores which form a definite fructification of their own with a well-defined hymenium.

2. *Corticium alutaceum* (Schrad.) Bres., has two methods of secondary reproduction: (*a*) conidia of a simple oidium-like nature produced on the young mycelium; and, (*b*) red-brown spore-balls or bulbils of the *Helicosporangium* type produced in great profusion on the mature mycelium.

3. *Peniophora candida,* n. sp., is the perfect form of the well-known *Ægerita candida* Pers., and commonly occurs with it.

4. *Corticium roseo-pallens* Burt, produces conidia in great abundance on the mycelium. The conidia closely resemble the basidiospores and are produced successively until groups of two to ten are formed on low elevations on the sides of the hyphæ.

5. *Corticium effuscatum* C. & E., produces mycelial conidia of the *Œdocephalum* type in all cultures, thus recalling Brefeld's *Heterobasidion annosum*. The mycelium also produces abundant chlamydospores.

6. *Lentodium squamulosum* Morg., the only fleshy fungus cultivated, bears helicoid conidia upon long attenuated hairs arising from the young veil and from the margin of the developing pileus. The principal interest attaching to this species, however, lies in the structure and method of development of the basidiosporic fructification. The stipe and pileus are those of an agaric, but the hymenial region is occupied by a thick layer of irregular tubes and chambers whose external openings are more or less completely closed by a white flocculent veil. Diffusely spreading hyphæ arising from the trama form this veil, and by influencing the direction of growth of the hymenial plates, cause the porose-cellular character of the hymenial layer. The writer believes that Lentodium is not a monstrosity, as has frequently been held, but is an autonomous species whose sys-

tematic position is between the Agaricaceæ and the Polyporaceæ.

Ascigerous Forms of Glœosporium and Colletotrichum: C. L. SHEAR and ANNA K. WOOD, Bureau of Plant Industry.

Stoneman, Clinton, Spaulding, von Schrenk and Sheldon have already given the life histories of a number of forms. Klebahn has also reported ascigerous stages of two species which have been referred to *Glœosporium,* but which are evidently not congeneric with the organisms studied by the other authors mentioned, and by the present writers.

Forms from eight different hosts have been grown in pure cultures and both conidial and ascigerous perithecia produced. The forms studied occurred upon the following hosts: grape (*Vitis sp.*), apple (*Pyrus malum*), cranberry (*Vaccinium macrocarpum*), rubber plant (*Ficus elastica*), locust (*Gleditschia triacanthus*), *Ginkgo biloba,* cotton (*Gossypium sp.*) and bean (*Phaseolus vulgaris*).

The form on the apple has been grown several times before. In none of the other cases mentioned has the ascigerous form been heretofore produced, as far as known. The forms investigated can not be specifically segregated by morphological characters, and for the present are regarded as varieties of a single species. The ascigerous form has been found upon its host under natural conditions in only two cases, viz., on the apple and *Ficus elastica.* The presence of paraphyses has been reported by Sheldon. Organs sometimes occur which, if not aborted or mal-formed asci, may be called peripnyses. The factors which determine the production of the ascigerous fructifications are still doubtful. Having once obtained a race or individual which produces asci, it can be successfully grown on various media and under various conditions. The mycelium, having entered the tissues of its host, has the power of remaining dormant for an indefinite period.

A New Chrysanthemum Disease—The Ray Blight: Professor F. L. STEVENS, North Carolina College of Agriculture and Mechanic Arts.

Specimens of this disease were first received from Fayetteville, N. C. It was later found in Raleigh. Its most conspicuous appearance is as a blight of the ray flowers of the head. It also occurs in the stems. Examination showed a fungus constantly present in the diseased part. This was repeatedly isolated by plate culture; its culture characters were studied on various media; and its temperature and acid relation were determined. Inoculations were then made upon chrysanthemums under various conditions, producing typical cases of disease. The organism was recovered from these artificially inoculated blossoms and proved identical with that found in cases of natural infection. The fungus belongs to the genus *Ascochyta,* apparently a new species for which a technical description is provided.

A Potato Leaf-blotch Fungus New to America: Professor L. R. JONES, University of Vermont.

The fungus in question is *Cercospora concors,* first described by Dr. Robert Caspary in 1854, from collections made in the vicinity of Berlin. Since that date it has been observed with increasing frequency in Europe, proving most serious in the northern sections. The author has found it in Vermont at three well-separated stations and in three seasons, the first collection having been made in 1902. It has occurred in each case in old gardens and the indications are that it is a well-established parasite on the cultivated potato and probably widely distributed in the longer settled parts of the northeastern states and

Canada. Its attacks are confined to the leaves. It develops at the same season and under generally similar conditions to the well-known early and late blight fungi (*Alternaria solani* and *Phytophthora infestans*) and bears so close a resemblance in gross appearance to these that it has probably been commonly overlooked or confused with these diseases. Its cultural characters have been studied in detail. On artificial media it produces only a resting form of chlamydospore, similar to that produced in dead potato leaves. It is believed that the usual spraying methods will hold it in check. Certain varieties of potatoes show well marked resistance to this fungus. A detailed account of these studies will appear in the forthcoming (1906) report of the Vermont Experiment Station.

A Bibliography of North American Lichenology: Professor Bruce Fink, Miami University.

The paper attempts to give all titles pertaining to North American lichenology, from the first certain statement regarding our lichens, about the beginning of the eighteenth century, to the present time, completing a preliminary announcement concerning the bibliography made in 'Two Centuries of North American Lichenology,' *Proc. Ia. Acad. Sci.*, 1–38, 1904. With each title appear explanatory notes as to contents.

American Fossil Mosses, with Description of a New Species from Florissant, Colo.: Elizabeth G. Britton and Dr. Arthur Hollick, New York Botanical Garden.

During the summer of 1906 Professor Theo. D. A. Cockerell and his wife made extensive collections of fossil plants in the well-known Tertiary beds at Florissant, Colorado. From among the specimens collected a beautifully preserved fossil moss, in fruit, was kindly transmitted to us for examination. It will shortly be described and published under the name *Glyphomitrium Cockerelleæ*. The specimen is here for examination.

Thousands of specimens of fossil plants have been obtained from this locality by other collectors from time to time, but only three which have been regarded as mosses have been heretofore brought to light, and none of these is in fruit.

This class of plants is exceedingly rare in the fossil state and all of the hitherto described American species are sterile, the generic determinations having been based entirely upon leaf characteristics, so that such determinations were neither conclusive nor satisfactory and in some instances even their reference to the mosses is questionable. The specimen before us may therefore be said to be the first one from America in which a positive identification has been possible.

Some Changes in Wood Fiber immersed in Water: Dr. H. von Schrenk, Missouri Botanical Garden.

Recent Identifications of Cretaceous Gymnosperms from Kreischerville, N. Y.: Dr. Arthur Hollick, N. Y. Botanical Garden, and Professor Edward C. Jeffrey, Harvard University.

One of the best founded adverse criticisms in paleobotanical work is that determinations of generic and family relationships of fossil plants are necessarily based almost exclusively upon external characters. This has undoubtedly been the case in regard to the determination of fossil leaves, both of angiosperms and of gymnosperms, and it will continue to be inevitable as long as only the impressions of the leaves are available for study. If, however, certain of the leaves or leaf impressions are found associated or actually connected with twigs, or branches, or cones,

or other parts in which the plant tissue is sufficiently well preserved for sectioning and microscopic examination, the ordinal, or family, or even exact generic relationships may be accurately determined.

Such conditions of preservation have been found in the Cretaceous deposits at Kreischerville, on Staten Island, and a large amount of material from this locality has been collected and subjected to critical examination. Some of the preliminary results thus obtained form the basis of this communication.

The lantern slides show microscopic enlargements of cones of *Protodammara*, sections of the wood of *Brachyphyllum* and other gymnosperms, demonstrating their Araucarineous affinities, and sections of *Pityoreylon* with resin canals, indicating the probable sources of the amber which is abundant in the deposits.

Some Vestigial Characters in the Cone of Pines: Professor E. C. JEFFREY, Harvard University.

Classification of the Genus Panicum: A. S. HITCHCOCK, U. S. Dept. of Agriculture.

In the comprehensive works of Bentham and Hooker (Gen. Pl.) and Engler and Prantl (Pl. Fam.) the large genus *Panicum* was divided into a number of sections, such as *Digitaria, Trichachne, Thrasya, Echinochloa, Hymenachne, Ptychophyllum* and *Eupanicum*. Most of these sections may more conveniently be considered as genera, this division being based upon well-marked characters of both structure and habit. Retaining the name *Panicum* for most of what has been included in the section *Eupanicum*, this genus may again be divided into groups, of which the following are American: *Ramileta, Fasciculata, Prostrata, Agrostoidia, Laxa, Maxima, Brevifolia, Verrucosa, Capillaria, Prolifera, Dichotoma, Parvifolia, Virgata, Diffusa, Divaricata* [Sect. Lasiacis]. These names should not be considered as sectional names. They are merely group names formed from a well-known specific name of each group. *Ptychophyllum* and *Lasiacis* should probably be assigned generic rank. The group *Dichotoma*, which includes about one hundred closely allied species of the southeastern United States, can again be divided into a number of subgroups, the classification being based upon habit, size and pubescence of skelatils, ligner, pubescence of culms, sheaths and blades, and the manner of branching of the fall culms. These groups are: *Depauperata, Laxiflora, Angustifolia, Eudichotoma, Nitida, Lanuginosa, Unciphylla, Eusifolia, Sphærocarpa, Corurnutata, Lancearia, Oligosanthia, Scoparia, Latifolia.*

DUNCAN S. JOHNSON,
Secretary

THE JOHNS HOPKINS UNIVERSITY

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

MEETING OF SECTION E—GEOLOGY AND GEOGRAPHY

ON account of the special meeting of the association at Ithaca in July, 1906, at which Section E had a full program of papers and excursions, no effort was made to get papers for the New York meeting of the association. Some fifteen papers, however, were spontaneously offered in addition to the vice-presidential address, and Section E held four sessions during the New York meeting.

At the session for organization held at Schermerhorn Hall, Columbia University, directly after the adjournment of the first general session of the association on December 27, Professor J. B. Woodworth, of Harvard University, was elected a member of the sectional committee for the term of five years, Professor N. M. Fenneman was elected a member of the general committee,

and Professor William H. Hobbs a member of the council of the association. Professor Fenneman was also elected press secretary.

The section, some sixty members being present, passed, with unanimity, a resolution recommending to the council of the association that the annual meeting of the association be held regularly during the summer vacation season. The section also passed a resolution recommending the formation of a seismological committee composed of fellows of the association from the different sections interested in the subject.

At 2 P.M. of the same day Professor William North Rice read his address as retiring vice-president and chairman, his subject being 'The Contributions of America to Geology' (SCIENCE, February 1, 1907). At 3 o'clock the section adjourned in favor of the Geological Society of America, which held its first business session in the same room. The Geological Society continued its sessions on Friday and Saturday in the American Museum of Natural History, and on Monday, likewise at the Museum, Section E resumed its meeting. Two sessions were held, at which the papers described below were read and actively discussed. The attendance at these sessions was highly satisfactory, especially in view of the lateness of the date and of the fact that the Association of American Geographers was holding simultaneous sessions in a neighboring building.

At the business meeting of the sectional committee held on Monday, December 31, Professor Joseph P. Iddings, of Chicago University, was nominated for the office of vice-president of the association and chairman of the section. The resignation of E. O. Hovey as secretary was presented and accepted, and Dr. F. P. Gulliver, of Norwich, Conn., was elected to fill the vacancy for one year thus caused.

The papers, abstracts of which follow, were read in full by their authors on Monday, December 31, at the American Museum of Natural History.

The Detrital Flanking Slopes of the Mountains of the Southwest: WILLIAM P. BLAKE, New Haven, Conn.

This paper described the long regular slopes of coarse sand, gravel and boulders bordering high rocky elevations of the mountains of the southwestern portion of the United States, particularly of the Great Basin and the arid region of Arizona, and discussed their origin, age and geological relations. Evidence was given that the detritus of mountain gorges was formerly deposited under water and was spread out by oceanic action so as to form the long smooth flanking slopes with their highest portions from 3,500 to 4,000 feet and the elevation of the country to an equal amount. The grade in slopes of from eighteen to twenty miles in length averages 100 feet to the mile. They have great antiquity, being probably preglacial, and certainly older than the existing drainage, by which they have in part been modified in form and partly destroyed. The study of these slopes throws much light upon problems of Quaternary geology and meteorology.

Professor Blake's paper was discussed by Professors Kemp, Ogilvie and Gill.

Perspective View of the Submarine Canyon of the Hudson River: J. W. SPENCER, Washington, D. C. (Abstract not received.)

Eurypterus Fauna of the Shawangunk Grit: JOHN M. CLARKE, Albany, N. Y.

The Shawangunk grit throughout its extent along its western ridge from Ulster County into the Kittatinny Mountains of New Jersey and on its eastern from Skunnemunk Mountain, Orange County, to Green Pond, New Jersey, had never furnished fossils until the work of the past

season brought them to light. In some of the Orange County exposures it has been found that above the basal conglomerate of the formation through the grit layers for a thickness of about 600 feet there are frequent repetitions of thin, black shale layers, inconstant in extent along the outcrops and in number and most of them bearing the remains of merostome crustaceans of the genera *Eurypterus, Pterygotus, Hughmilleria* and their allies. The fauna must have been an extensive one, as the remains are various and abundant, but the preservation leaves much to be desired, especially in the case of the larger crustaceans, whose surface has afforded opportunity for shearing and consequent deformation or destruction of the part. Yet in some respects the preservation has been remarkably favorable for small individuals, and these shales have afforded the most diminutive examples of these interesting creatures yet brought to light. The presence here of the genus *Hughmilleria,* heretofore known only in the Pittsford shale at the base of the Salina series in Monroe County, is sufficient evidence of the contemporary age of this arenaceous mass. In themselves the fossils are extremely interesting, affording some details of ontogeny not before recorded for these ancient merostomes. It is entirely evident, in the author's opinion, that these crustacean faunules running through the strata for so great a thickness indicate temporary and very changeable brackish water pools over the surface of a rapidly accumulating delta derived from the drainage of the high, folded lands to the northeast, and the deposit laid down in an embayment entirely separated from the salt pans and Dead Sea conditions of central and eastern New York by a barrier lying approximately in the present position of the Helderberg Mountains.

Dr. Clarke's paper was discussed by Professors Grabau, Lane, Ami and Clarke.

Kentucky Rock Asphalt for Common Highways: MALCOLM HART CRUMP, Bowling Green, Ky.

This paper treated Kentucky rock asphalt as to its composition, analysis and probable origin and discussed its geological horizon. The location and amount of available material and its economic uses as a water-proof and dust-proof road-surfacing substance were considered, and experiments as to its use were described. Its durability as shown by tests made on the streets of Bowling Green, Ky., and the results of a recent preliminary inspection by the Office of Public Roads, U. S., were given. The present demand for such material was stated and the cost of mining, crushing and grinding the Kentucky rock ready for use was detailed.

Professor Crump's paper was discussed by Professors A. M. Miller, Ami and Sternberg.

Portheus molossus, Cope, and Other Fishes from the Kansas Chalk: CHARLES H. STERNBERG, Lawrence, Kansas.

This communication described a specimen of *Portheus molossus,* Cope. The paper was illustrated by a photograph in which were shown the tail fins, the upper one 28 inches long, 37 continuous vertebræ with dorsal fin in position as are also the pelvic, so found for the first time after experience of 40 years, exploration of the fossil beds of the west. The author also called attention to the beautiful set of pectoral fins with connecting arches, each three feet long, armed with 60 teeth. The specimen is now the property of the British Museum.

Subaerial Erosion Cliffs and Talus in the Lower Devonic of Michigan: A. W. GRABAU, Columbia University.

Cliffs fronted by talus heaps of huge limestone blocks were formed in the lower Devonic of Michigan. The cliffs consisted of the Marine calcilutytes and their débris was incorporated in the Dundee calcarenytes. The brecciated limestone of Mackinac Island is a characteristic portion of these early Devonic talus heaps.

Professor Grabau's paper was discussed by Professors Lane, Foerste, A. M. Miller and Foerste.

The Naples Fauna in Michigan: A. W. Grabau, Columbia University.

The occurrence of the strata at the top of the Traverse group with the Goniatite fauna of the Naples horizon was described.

Professor Grabau's paper was discussed by Professors Ami and Bell.

Types of Cross-Bedding and Their Stratigraphic Significance: A. W. Grabau, Columbia University.

Four types of cross-bedding, the subaqueous, or delta, type, the torrential type and the æolian type, were considered. The occurrence of the last two as evidence of continental origin of the formations in which they are found was discussed. The type of cross-bedding of the Pottsville conglomerate bears out the conclusions already reached from its overlap relations, namely, that this formation is of fluvial origin.

Professor Grabau's paper was discussed by Professors A. M. Miller, W. G. Smith, Fairchild, Grabau, Lane, Ami, Fairchild, Grabau, Lane, Hovey, Woodman and Grabau.

The Cumberland Coal Basin, Nova Scotia: J. Edmund Woodman, Dalhousie Univ., Halifax, N. S.

The paper described the Carboniferous and Permian rocks of this basin, especially with reference to the source of material, and the great overlap produced by the New Glasgow conglomerate. From the structure and lithology of the basin, the following conclusions are reached:

(1) That the sediments were laid upon a differentially sinking floor, the shore line a variable one against the Cobequid range to the south, the detritus of the sediments being directly derived from these mountains; (2) conditions favorable to the formation of coal existed over a large part of the area bounded on the north by the outcrop of the Joggins zone of seams, on the east by the Springhill district, on the south by the Cobequid mountains, and on the west by a line down the middle of Chiquecto bay; (3) these conditions became adverse shoreward, because of the violence of wave action, and seaward, through deepening of the water; (4) through the differential sinking of the bottom and shore, beginning during the time of the coal measures and continuing into the Permian, slight in amount in the east and increasing westward, an overlap of the Permian upon the Cobequids has been established, burying the coal horizons over all the southern part of the basin except the east end; (5) the horizons containing the Joggins and Springhill seams extend under the basin, blanketing at a considerable depth, and rising westward, outcropping under the center of Chiquecto bay on the west; (6) this horizon swings eastward at the north, appearing on the shore at the Joggins, and eastward at the south, plunging beneath the Permian overlap before reaching the shore, hence covered at all points on the south side of the basin; (7) it is probable that coal occupies this horizon throughout this area, as indicated by the persistence of the Joggins zone of seams, the abundance of the Springhill coal, and the occurrence of a thick seam at 2,250 feet in a borehole at Fullerton lake, less than half-way from the shore of Chiquecto bay to Springhill; (8) the summit of the Coal Measure should lie against

the Cobequid granite beneath a point slightly south of Apple River; (9) the Apple River borehole and the second hole at Fullerton lake indicate that the fine sediments of the Coal Measures are replaced shoreward by coarse detritus, continuous upward with the New Glasgow conglomerate of the Permian, so that coal, if present in the main portion of the western half of the basin, frays out southwards; (10) that the strata on the shore of Chiquecto bay are such as bring the Coal Measures 1,400 feet nearer the surface than at the first Fullerton Lake borehole, and over 2,000 feet nearer than on the floor of the basin north of Fullerton Lake.

Professor Woodman's paper was discussed by Professors Grabau, Woodman, A. M. Miller, Lane and Woodman.

Charles Willson Peale's Painting. 'The Exhuming of the First American Mastodon': ARTHUR BARNEVELD BIBBINS, Baltimore, Md.

Charles Willson Peale, who was born in Chestertown, Maryland, in 1741, and known as 'the artist of the Revolution' was among the first to interest himself in American vertebrate paleontology. Although very few of his hundreds of paintings deal with this subject, one has lately come to light which vividly portrays his keen and practical interest in this direction. This is a canvas six by five feet, painted in 1823 a few years before the artist's death. It is in a good state of preservation and owned by a direct descendant of Peale. The subject is 'The Exhuming of the First American Mastodon.' Peale is represented as personally supervising the excavation, with other scientific worthies of the day and some members of his family in attendance. Although the figures are small the detail is so perfect that the several personages shown are readily recognizable. An elaborate and ingenious device for ridding the excavation of water is a notable feature.

Family history has it that the locality was somewhere in Delaware or New Jersey, that the skeleton was first erected in Philadelphia, that the discovery was celebrated by a dinner held beneath it and that the building containing it was ultimately burned. Family history also relates that Peale was induced to undertake the exhuming of the mastodon by Baron von Humboldt, who had visited this country a few years earlier and was the artist's guest.

The Peale family was also among the first in America to encourage the establishment of natural-history museums, for among the records we find that while Humboldt was visiting Charles Willson Peale and while these gentlemen were entertained at a formal 'three-o'clock dinner' by President Monroe, the guests improved their opportunity by asking the president to endeavor to induce Congress to establish a National Museum; also that Peale returned from the interview much elated by the assurances that action would shortly be taken.

In 1813 the artist's son, Rembrandt, started the erection of a Natural History Museum in Baltimore, having previously excited interest in such matters by the exhibition of the skeleton of a mammoth. This building, later known as the 'Old City Hall,' is still standing, and bears the original legend 'Peale's Museum.'

Additional Evidence of Tropical Climate on the Middle Atlantic Coast during the Lower Cretaceous: ARTHUR BARNEVELD BIBBINS, Baltimore, Md.

No better evidence of tropical or subtropical climate is needed than the existence of dinosaurs as a dominant faunal element, if it be presupposed that reptiles as a class have always been as partial to

such climate as they are in our own time.

On the same principle, tropical climate is implied by the domination of the flora of a period by such plants as the cycads; and at least subtropical conditions by such conifers as the Sequoia. All of these warm climate representatives have long been known to have prevailed on the Middle Atlantic Coast during Middle Secondary or Lower Cretaceous time; but during the past year another tropical group has suddenly come to light, viz.: the palms. Mr. E. W. Berry appears to have been the first to detect them in a somewhat doubtful fragment of a frond from the Magothy formation or the Upper Chesapeake Bay. Shortly after, there came to the writer's notice some half dozen fragments of different silicified palm trunks, chiefly from a single neighborhood in the Lower Cretaceous belt, between Baltimore and Washington, suggesting that these fossils are likely to prove, upon systematic search, in other Lower Cretaceous areas to be of scarcely less frequent occurrence than the silicified sequoia and cycad trunks of those areas, thus greatly emphasizing the evidence of the tropical climate of their time.

Geology of Core Bank: Collier Cobb, Chapel Hill, N. C.

The coast from Hatteras southward is rising, not subsiding. As the dunes advance toward the Sound side they depress by their weight the swamp muck in which the trees of that side grow, and these are left exposed on the seaward side when the dunes have passed. This compression of the muck is often mistaken for subsidence of the land. On the land opposite the Core bank successive strata of muck filled with well-rounded blown-sands rise twenty feet above Core Sound at Atlantic. Kitchen-middens, too, mark this line of elevated dunes.

Drum Inlet was opened by a storm on October 17, 1906, and Tertiary shell-rock thrown upon the bank. Numerous Cretaceous fossils, such as the author has already reported from Currituck Bank were found along the entire length of Core Bank, which dates back to Cretaceous time at least. Whalebone Inlet between Core Bank and Portsmouth Island has again been closed.

There is thus no longer any question as to the origin of Core Bank or of Currituck Bank, for they are both essentially parts of the mainland. Currituck Sound was formerly a river that flowed into the old Albemarle or Caroline River before the present Albemarle Sound was formed by the drowning of that valley; and Core Sound was for the greater part of its length a southern tributary of the large river made up of the Pamlico and the Neuse and passing to seaward through the present Ocracoke Inlet. The Albemarle River passed through the present fresh ponds just south of the Kill Devil Hills, and the margin of the continent was some three score miles eastward of its present position.

The following papers were read by title:

The Low-Water Channel of the Mississippi River: Robert Marshall Brown.

Walnut Canyon, Arizona, Section compared With Rocks of Similar Age in the Territory: H. W. Shimer.

Structural Control of Surface Features in the Highlands of the Hudson: Charles P. Berkey.

The Occurrence of Diamonds in North America: George Frederick Kunz.

A Lower-Middle Cambrian Transition Fauna From Braintree, Mass.: H. W. Shimer.

Notes on the Upper Aubrey of Northwestern Arizona: H. W. Shimer.

Edmund Otis Hovey,
Secretary

SCIENTIFIC BOOKS

Lectures on the Theory of Functions of Real Variables. Volume I. By JAMES PIERPONT. Boston, Ginn and Company. Pp. xii + 560.

A considerable part of the present volume is in very close touch with problems which confront the students of elementary mathematics, dealing with such questions as the difference between rational and irrational numbers, the theory of limits and the concepts of continuity and discontinuity. Bright and thoughtful students frequently seek more light on these subjects than they can find in the elementary text-books and many teachers will doubtless rejoice to find that a large amount of most interesting information along these lines has been made accessible by a scholar in whom they can have the utmost confidence.

A little more than a hundred pages are devoted to the fundamental matters which are to serve as a basis for the notion of function in general. This notion is illustrated by means of the trigonometric functions with which the reader is supposed to be familiar and a very brief proof is given of the interesting fact that these functions are transcendental. The descriptive introduction to functions is followed by a similar introduction to point aggregates in which several fundamental theorems relating to limiting points are proved and a number of the common terms are defined and illustrated. The theory of point aggregates furnishes some of the most interesting instances of the distinction between finite and infinite multitudes, and the importance of this theory is partially illustrated by the fact that one of its terms (dense) is needed as early as page 20 to describe the system of rational numbers.

The greater part of the present volume deals with questions which the student approaches in the elementary calculus. The processes of differentiation and integration are treated with a completeness which seems impracticable in a first course, yet this completeness is essential for a thorough comprehension of the subject. A very helpful feature is furnished by the 'numerous examples of incorrect forms of reasoning currently found in standard works on calculus.' It has been "the author's experience that nothing stimulates the student's critical sense so powerfully as to ask him to detect the flaws in a piece of reasoning which at an earlier stage of his training he considered correct."

The vast extent of the applications of the processes of calculus have frequently led writers to overlook the regions where these processes do not always lead to correct results. Even some of the most useful formulas, such as

$$dy/dt = dy/dx \cdot dx/dt,$$

appear in nearly all, if not in all, of the other English texts with an incomplete demonstration. Arts. 378–80, which are devoted to a satisfactory demonstration of this formula, exhibit also the missing elements in the common demonstrations and suggest a method for an elementary demonstration in case a function has only a finite number of oscillations.

The last three chapters are devoted to improper integrals and to multiple proper integrals. These naturally contain much more original matter than those which precede. This is especially true of the last chapter, which is practically an original contribution. The definition of an integral is taken in the most general fashion and includes all the possible fields, whereas until then the most general was Jordan's and this is restricted to the inner points of a field. No other work contains such a complete treatment of the subject of uniform convergence as is found in these chapters.

The present volume, which is to be followed by another along the same lines, seems especially timely in view of the movement to employ the notion of function much more generally in the elementary courses in algebra and geometry. Teachers of secondary mathematics should have a clear understanding of the concept of function and we know of no other work where an accurate knowledge of this concept can be acquired as readily as from the earlier chapters and the criticisms of the present treatise. The fact that Ginn & Company should undertake the publication of such works as this and Goursat's 'Course in

Mathematical Analysis' is a very encouraging sign of the growing interest in higher mathematics and these works will doubtless do much towards increasing this interest. In following the pages of Professor Pierpont's work one feels that one is being led by a master of his subject and a sympathetic teacher, and these elements combined with the nature of the subject make the present work one of the most significant publications on pure mathematics that have ever appeared in this country.

G. A. Miller

University of Illinois

Electrical Nature of Matter and Radioactivity. By Harry C. Jones. New York, D. Van Nostrand Company. Pp. viii + 220. Price $2.

Another semi-popular book upon a well-worn subject, but a book which on the whole justifies its existence by the treatment, found in the last seventy-five pages, of the results of investigations and discussions so recent that they have not yet found place in other books on radioactivity. Thus the discussions of recent work on the origin and distribution of radium, of the properties of the α and β rays, as lately worked out by Rutherford and Bragg, of the 'radiobes' of Burke, of the decomposition products of actinium, and of radiothorium, are all new and all thoroughly commendable.

The book as a whole lacks somewhat in unity of treatment, the different sections differing considerably in value and in method of presentation. The treatment of radioactivity, which occupies all save the first third of the book, although it is non-mathematical, is on the whole thoroughly scientific, being characterized by an admirable moderation of statement, a scholarly collection of all the available experimental data, evidently from the original sources, and a judicious balancing of arguments for and against rival hypotheses. It will be read with interest and profit by physicists and chemists. It contains a commendably small amount of the sort of material which seems to be designed chiefly as food for the popular imagination.

The chapters dealing with the electrical nature of matter seem, on the other hand, to have been written largely for popular consumption and their faults are those most common to literature of this type, namely, incompleteness in the presentation of the facts and a rather immoderate haste in arriving at positive conclusions, the author's attitude being that of the ardent convert to the electrical-nature-of-matter *hypothesis* rather than that of the judicious disseminator of the present state of scientific knowledge in this field. Thus in discussing in the first chapter the value of e/m for the corpuscle, he slurs over the differences between the values found by different observers working with cathode rays, Lenard rays, photo-electric effects, the Zeeman effect, and radium rays, and says simply that the answer to the question as to the constancy of e/m for negative corpuscles is unmistakably given by the results which have been obtained. When it is remembered that these values vary for slow-moving corpuscles from 4×10^6 to more than four times that number, namely, 18.7×10^6, the statement appears rather too strong even for a popular article. Thus far these differences are certainly not to be explained by *probable* observational errors. It is to be hoped that further experimenting will soon reveal the causes of the discrepancies. The value of e/m which the author uses throughout the book is 7.7×10^6 instead of 18.7×10^6, the value given by the most reliable experiments, especially those of Seitz (*An. d. Phy.*, Vol. 8, p. 223), who succeeded in bringing the results obtainable by the three different methods used in the study of cathode rays into close accord. The value 7.7×10^6 is, of course, inconsistent with Kaufmann's measurements upon the variation of e/m with speed according to which this quantity changed from 6×10^6 to 13.1×10^6 as the speed varied from .94 to .7 that of light.

The feature of this part of the book, however, which is least commendable is the confusion either of ideas or of terms involved in such statements as the following: "Matter is then a pure 'hypothesis'—'there is not the least evidence for its existence.' Energy is the only reality." Now, of course, every trained reader knows that in the ultimate an-

alysis of things there is nothing in the universe which is not hypothetical to any particular individual except the fact of his own consciousness. But the ordinary reader will scarcely understand that in the above statements the author is merely denying the existence of matter in the broad, metaphysical sense in which the philosopher denies the existence of any external world whatever. He will rather understand him to be using language in the sense in which it is commonly used in books on physical subjects, and to be tacitly assuming the existence of an external world and yet denying the existence of matter as a constituent of that world; and indeed this is certainly what he does do, since in the next sentence we find him asserting the reality of energy.

Such assertions seem to me to be particularly fruitful of confusion of thought in the minds of the untrained, while to the trained they are devoid of all meaning. For *matter* 'as we ordinarily understand the term' does not involve any particular hypothesis as to the inner nature of the atom. As commonly understood, matter is merely that something which possesses the properties of weight and inertia. Its existence is, therefore, just as real as the existence of these properties. As investigation goes on the more properties which we find ourselves agreed in associating with weight and inertia the more definite does our idea of matter become. Thus there is now practical unanimity in regarding matter as composed of discrete particles, and recently some evidence has appeared which makes it plausible at least to endow the discrete particles with an electrical property as well as with weight and inertia, and it has also been suggested that the inertia property may be entirely wrapped up in the electrical property. If further experimenting should justify this hypothesis the term matter would lose none of its present significance, but would rather gain additional meaning, just as the term 'light' gained rather than lost in significance when Maxwell and Hertz discovered a relation between light and electricity. The assertion that light 'is a pure hypothesis, that there is not the least evidence for its existence,' would be in every respect as warrantable as the similar assertion regarding matter. Either assertion, I take it, is completely misleading in popular writing, even though there may be some technical justification for it.

But I can see no sort of justification, technical or otherwise, in denying the existence of matter and in the same breath asserting that 'energy is the only reality'; for, since energy is *defined* only in terms of matter and motion, it is obviously absurd to consider it any more real than matter. It is merely a case of the recrudescence of the confusion of ideas which Boltzmann and Planck eliminated to so large an extent from German thinking by their masterly articles on 'Energetik' which appeared in *Wiedemann's Annalen* in the winter of 1906. Of course, no one will deny that it might, perhaps, be possible to describe natural phenomena from some other view-point than that which has been adopted by the master minds of science from Galileo and Newton down to J. J. Thomson, and to start with a fundamental something which might be called energy instead of with the something which we now call matter, but this possibility, if it be a possibility, has certainly not yet been realized, and the attempts which have thus far been made in this direction have resulted only in a confused mass of logical contradictions, so that, in point of fact, energy, as the term is now used in scientific literature, is still defined in terms of matter, space and time. In view of the gross abuse which the word energy commonly receives at the hands of the unthinking, an abuse which is well illustrated by the effort which is sometimes made by high school teachers to 'get at everything,' as they say, from the standpoint of energy, even before their pupils have been taught enough mechanics to make a concise conception of the meaning of energy possible, in view, I say, of this popular abuse of the term it is particularly desirable that men of science do not add to the confusion by using it in a loose and indefinite sense.

R. A. MILLIKAN

UNIVERSITY OF CHICAGO,
January 28, 1907

SCIENTIFIC JOURNALS AND ARTICLES

The American Museum Journal for January announces that in order to emphasize its news features it will henceforth be issued monthly from October to May, inclusive. The guide leaflets will not be included, but will be issued at intervals as occasion requires. The number notes 'A Zoological Expedition to New Mexico and Arizona,' describes 'The Skeleton of the Columbian Mammoth' recently placed on exhibition and gives its height at the shoulder as ten feet six inches. There are accounts of the three expeditions sent out last year by the department of vertebrate paleontology, and of the Selma meteorite, an aerolite weighing 310 pounds, which ranks it among the largest ten of this class of meteorites.

The Museum Gazette, of Haslemere, Eng., for January, contains among other interesting articles an extract from 'The General Guide to the Contents of the British Museum' published in 1762, which tells how admission was then obtained to that institution:

> Some of my readers may be ignorant of the Manner of applying to see the Museum; for their Information I shall add, that fifteen Persons are allowed to view it in one Company; the Time allotted is two Hours; and when any Number not exceeding fifteen are inclined to see it, they must send a List of their Christian and Sir-names, Additions, and Places of Abode, to the Porter's Lodge, in order to their being entered in the Book; in a few Days the respective Ticket will be made out, specifying the Day and Hour in which they are to come, which on being sent for, are delivered. If by any Accident some of the Parties are prevented from coming, it is proper they send their Tickets back to the Lodge, as no body can be admitted with it but themselves. It is to be remarked, that the fewer Names there are in a List, the sooner they are likely to be admitted to see it.

Under 'Museum Statistics' we learn that there are 330 museums and art galleries in the United Kingdom, situated in 225 cities, towns and villages. This seems a pretty good showing, but is evidently not so regarded by the writer. The attendance, outside the national institutions runs from 1,480,000 at the Glasgow Art Gallery to 'practically *nil*' at Frome. The best comparative attendance is at Ilkley where there were 4,000 visitors in a population of only 7,000.

Bird-Lore for January-February has for its frontispiece the bust of Audubon recently unveiled at the American Museum of Natural History and this is followed by the address on 'John James Audubon' delivered at the unveiling, by C. Hart Merriam. 'Florida Bird Notes,' by T. Gilbert Pearson, show the great increase of the pelicans. There is a good article on 'Bluebird Tenants,' by Marian E. Hubbard, and then comes 'Bird-Lore's Seventh Christmas Bird Census,' a most comprehensive series of observations. We have the first paper on 'The Migration of Thrushes.' F. A. Lucas and Thomas H. Montgomery discuss 'Oology as a Science' and 'The Question of the Amount of Science in Oology.' The Educational Leaflet, by Mabel Osgood Wright is devoted to the 'Bluebird.' The reports of Audubon societies from various parts of the country are very encouraging and show an increasing effort to protect the birds, with here and there a jarring note from some one who is quite willing to wipe them out of existence.

The Bulletin of the Charleston Museum for January contains the report of the director for 1906, which shows most encouraging progress in various lines. Dr. Rea is to be congratulated on his success in revivifying this, the oldest of our museums, and on his foresight and energy in hunting up the collections and preserving their records.

The Plant World for February will contain the first installment of a series of articles by Dr. Pehr Olsson-Seffer, who is now on a journey around the world with the special purpose of studying methods of tropical agriculture. There is also a paper by Dr. MacDougal upon field hybrids among oaks; and by Professor F. E. Lloyd on the diurnal flowering period of certain cacti. The issue contains, also, a large number of short items of general interest.

SOCIETIES AND ACADEMIES

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

THE 626th regular meeting was held January 5, 1907, with President Hayford in the chair.

The first paper of the evening was presented by Mr. L. W. Austin, describing some recent developments of wireless telegraphy and giving a comparison of the efficiency of continuous and broken wave trains in wireless signaling.

The experiments were carried on at the wireless station at Brant Rock, Mass., during the past autumn, the distance between the two antennæ being about three miles. The continuous wave trains were produced by a small Fessenden high frequency dynamo which during the experiments was run at 50,000 cycles per second. The broken wave trains were of the same frequency and produced by a spark in the usual manner. The receiver used was of the electrolytic type. Below are given the data of one of the experiments:

	Machine	Spark	
Energy	50 watts	225 watts	
Current in sending antenna	1.6 amp.	0.9 amp.	
Strength of signal	5	20	in arbitrary units
Current in receiving antennæ	2.2	4.5	in arbitrary units

the loudness of the signal being proportional to the square of the received current. If we reduce the received current to terms of the same radiation current, the spark would give 3.6 times as strong received current as the machine. Reduced to terms of the same energy the two are nearly equal in efficiency, the advantage being slightly in favor of the machine.

Mr. O. B. French spoke of 'The Recent Use of Invar Tapes for the Measurement of Primary Bases.'

Since the discovery of the alloy of nickel and steel (called invar, from invariable) which possesses a very small coefficient of expansion, its use for precise measuring apparatus has been tested very carefully. Most of these investigations have been made under the direction of C. E. Guillaume, of the International Bureau of Weights and Measures at Paris. His experiments having proved the metal to be fairly stable, the Coast and Geodetic Survey decided to try it for the measurement of primary base lines.

In December, 1905, the survey purchased from J. Agar Baugh, London, England, several ribbons of the invar tapes, 6.3 mm. in width, 0.5 mm. in thickness and 53 meters in length, which were prepared for measuring tapes in the instrument division of the survey.

During 1906 the survey measured six base lines, using on each base three invar tapes, in daylight (standardized at the National Bureau of Standards) and also three steel tapes, at night (standardized in the field).

Several pieces of the invar tapes, tested at the Bureau of Standards, showed a tensile strength of 100,000 pounds per square inch (about one half that of steel tapes), with the elastic yield point about 70 per cent. of the tensile strength.

The tapes were tested for considerable ranges of temperature, reeled and unreeled a large number of times, and also tested for continued application and removal of light loads, without showing any change in length. The coefficient of expansion of the invar tapes was found to be .0000004 per degree centigrade or 1/28 that of steel.

The steel and invar measures of the six bases were computed independently. The differences between them are small, the largest being 1:300,000 (3 mm. per km.) and the average about 1:500,000.

The probable errors of the lengths of the bases from the steel measures are more than double those from the invar measures. The final probable errors of the bases, giving the invar double weight, are between 1:2,500,000, and 1:5,000,000 (0.4 mm. and 0.2 mm. per km.).

In 1900 the Coast and Geodetic Survey demonstrated that steel tapes gave practically the same accuracy as bar apparatus with one third of the cost. It is now shown that the invar tapes give results considerably more accurate and economical than the steel tapes.

Mr. W. P. White then made some informal remarks upon 'Suspended Galvanometer Sup-

ports,' stating that the more rapid movement of the Julius suspensions and similar supports, probably on account of the rapidity, does not perceptibly affect ordinary moving coil galvanometers; hence for such galvanometers placing at the center of gravity, etc., is usually unnecessary, and the supports for such galvanometers may be given great simplicity and wide variety.

The effectiveness of a suspended support can easily be shown to be less for slower movements of the building; hence for a double reason these slower motions constitute the chief difficulty with the moving coil galvanometer.

By hanging one support from another, each provided with its own damping arrangements, a considerable gain in efficiency can be shown theoretically. This has not yet been thoroughly tested experimentally.

R. L. Faris,
Secretary

THE BIOLOGICAL SOCIETY OF WASHINGTON

The 27th annual and 422d regular meeting was held December 15, 1906. The following officers were elected for the ensuing year:

President—Leonhard Stejneger.

Vice-presidents—T. S. Palmer, W. P. Hay, E. L. Greene, E. W. Nelson.

Recording Secretary—M. C. Marsh.

Corresponding Secretary—W. H. Osgood.

Treasurer—Hugh M. Smith.

Councilors—A. D. Hopkins, J. N. Rose, A. K. Fisher, A. B. Baker, David White.

President Stejneger was nominated as a vice-president of the Washington Academy of Sciences.

The 423d regular meeting was held January 12, 1907, President Stejneger in the chair and forty persons present.

Mr. Maxon exhibited a nest made apparently by a mouse chiefly from horse hair. The nest was found upon the ground near Oneida, N. Y. Mr. Bailey said the locality of the specimen made it remarkable. The harvest mouse weaves nests of this type, using similar fine material, but Washington is the northern limit of distribution of the species. Dr. H. M. Smith noted the late autumnal flowering (November 10, 1906) of the bluet, *Houstonia cærulea*, an early spring species. Mr. Morris observed on November 15 a late flowering of *Phlox subulata*, and Mr. Clark on January 6 saw the early flowers of the skunk cabbage and the latest of the witch hazel.

Dr. Smith commented on the death on December 16, 1906, of Captain Z. L. Tanner, retired, a naval officer prominent in marine research as commander for many years of the *Albatross* on both coasts, in which capacity he has rendered great service to science.

Mr. Van Deman exhibited specimens of the Grimes apple and remarked upon the superiority of this variety. Mr. Titcomb showed an interesting anomaly in a frog which had an additional pair of hind legs. A radiograph of the specimen was shown.

Mr. M. B. Waite presented the first paper of the evening on 'A New Peach Blight from California.' The speaker stated that this peach blight was not entirely new, it having been described by Beijerinck. Pierce, in his bulletin on peach leaf-curl noted the presence of a winter blight on the peach, which, he stated, 'is probably induced by a *Coryneum*.' He mentioned the gumming habit as similar to that of *Coryneum Beyerinckii*.

The disease has evidently been in California for several years, but during the last three or four years it has increased to alarming proportions in the great interior valley of California and in the adjacent smaller districts. Especially in the more humid sections has it seriously crippled the peach industry, cutting down the production of some of the most profitable orchards to less than one half, or even a quarter, of a crop.

While in California investigating pear-blight, the writer was appealed to by peach growers for assistance. When this disease was thus submitted to him, early in February, 1905, it was easy, on microscopic examination, to promptly identify it as produced by the gumming fungus of Beijerinck, *Coryneum Beyerinckii* Oud., the writer having become familiar with the disease in 1898 through specimens sent in from Clyde, Ohio. It was known to occur occasionally in other eastern peach-growing sections. It had not attracted attention, however, as a serious disease until this

recent outbreak in California. The next day, after identifying the fungus, in the orchards at Suisun, Cal., the serious character of the outbreak of this disease became evident. All over the one-year twigs of the peach trees the small spots of the fungus were apparent. Many of the spots were necrotic and exuded gum at that early date. Scarcely an inch of the sound twig growth but carried one or more spots. Furthermore, the fungus had attacked the buds and killed and ruined by far the larger proportion of them, in many cases from 90 to 95 per cent. were already dead. On jarring the trees a shower of these dead buds fell to the ground, others were glued fast to the twigs by the gummy exudate. As the season advanced and the buds opened into blossoms the scarcity of the latter became more and more apparent. The spots on the twigs and the diseased buds exuded drops of gum which frequently ran down the twigs or dropped to the ground.

Spraying with Bordeaux mixture was at once suggested as a promising remedy, but the writer was informed that this had been tried and had proved to be a failure. Upon further questioning and an examination of the sprayed trees it was found that the treatment had been made some two weeks before, while the spots were in many cases older. The suggestion was then immediately made that spraying would have to be done in the fall or early winter, considerably ahead of the first appearance of the new infections.

This proved to be the key to the treatment of the disease. Three growers at Suisun, J. S. Brown, Geo. Reed and J. S. Chadbourne, sprayed blocks of trees in December, 1905, with Bordeaux mixture; in one case where the disease had been unusually severe the year before the trees had been sprayed a second time about January 15, 1906. Upon examining them late in March there was to be found scarcely a single diseased bud upon the sprayed trees, and where one was found, it was on a twig not reached by the spray. The contrast between the sprayed and unsprayed trees was very striking, the disease being even more severe in 1906 than in previous years. I was informed that the good results became even more noticeable as the fruit was harvested, immense crops of fine fruit being picked from the treated blocks, while adjacent orchards, often of the same variety, separated only by a wire fence, were practically failures. The crop of fruit in one case where the trees had been thoroughly treated, reached 42 tons from 100 trees, and in another case 400 trees yielded 100 tons of fruit, and similar productiveness occurred with other varieties.

The disease scarcely ever kills the tree, except possibly a young one, but it kills a great many of the branches, cripples the tree and ruins its productiveness.

Further experiments are in progress this year, beginning early in November, 1906, to test more definitely the most desirable dates for spraying, number of treatments, strength of Bordeaux mixture and the possibilities of using other sprays, especially the lime-sulphur preparation. This lime-sulphur spraying is done quite regularly in many California orchards, as well as in certain sections of the eastern states to prevent the San Jose scale. If this spray proves effective it may only be necessary to change the date from late winter or early spring to fall or early winter and thus prevent both the scale and the peach blight.

This *Coryneum* occurs not only on the peach, but is seriously injurious on the almond and apricot as well in California. It is known to be an important factor in most of the recent failures in the productiveness of these orchards. Experiments are also in progress in the treatment of the disease on these fruits.

In answer to a question, Mr. Waite said there was little doubt that the blight existed in Oregon and Washington, though it had not been definitely observed.

The second paper, by Mr. John W. Titcomb, was entitled 'Some Work of the Beaver.' While engaged in field work Mr. Titcomb visited Maskinonge County in the province of Quebec and during the month of June discovered on Lake Madam Henry a series of four freshly-built beaver dams. The upper one raised the lake some two and a half to three feet, overflowing quite a large area of lowland at the head of the lake where the

beavers proceeded to cut down poplar trees, and two months later from these cuttings had constructed a house on one side of the lake midway between the overflowed land and the dam.

Views were shown of the dam, including one showing the methods of the Indians in trapping beavers (unlawfully), of the house as it appears from the lake and also from the shore, and of the house together with a pile of cuttings for the winter's supply. Several views were also shown of the work of the beaver in the overflowed land. A view was also presented of a beaver dam on another lake about 100 miles distant from Madam Henry which practically divided the lake into two parts, the water level of one half being raised considerably above that of the other half. Incidentally a view was shown of beavers at work, a picture taken in the daytime by Mr. W. E. Balch, which was awarded first prize by *Recreation*. The award was afterward withdrawn, because it was charged that the beavers had been killed and fastened into position before the photograph was taken.

In the discussion following Mr. Titcomb referred to the unreasoning methods of the beaver, citing their apparent inability to control the direction in which the tree should fall, this apparently depending on chance. Trees felled are often found unused and with the limbs uncut, owing to their unfavorable position. The beaver frequently cuts in two a stick it is dragging, in order to get it over a log, instead of going around. Dr. Hopkins related an instance occurring in Maine in which beavers had attacked a man-made dam which had backed water into their own works. They had confined their assaults to the braces, which were considerably gnawed, leaving untouched the posts and sills. A guard became necessary until the beavers gave up their attempt.

Dr. Evermann called attention to a study of a large number of beaver dams from an engineering standpoint by Mr. Edward R. Warren, of Colorado Springs. The general conclusion reached was that beavers show little engineering sense in their construction work.

Mr. Vernon Bailey offered the third paper, on 'The Mountain Haymakers or Pikas' (Ochotona), little animals related to both the rabbit and the guinea-pig, sometimes called cony, pika, little chief hare, maginty rabbit, or maginty. The paper was illustrated with lantern slides.

The ochotonas live among the rocks, high up in the mountains, mainly near timber-line, from New Mexico and California to Alaska, and while often abundant are comparatively little known. They are approximately of the size and form of the guinea-pig, with rounded ears, short legs, and no visible tail. Their call or alarm note is a nasal squeak somewhat resembling the bleat of a very young lamb.

During late summer and the short autumn these little animals are busy gathering their winter store of hay, including plants of many species that they cut and stack in dry places under the shelter of broken rocks that lie in masses on the steep mountain slopes. Often a bushel or more of well-cured vegetation is gathered into one of these sheltered deposits and a dozen or more stacks are sometimes found within the area of a not very extensive rock slide. Almost every plant within reach is gathered, with apparently little specific discrimination. In one place on the side of Pecos Baldy in New Mexico 34 species of plants were recognized in the hay, including 9 species of grass, a sedge, two species of clover, part of a large thistle, flowers and stems of the blue columbine, a purple *Pentstemon*, a little sour-dock, a saxifrage, a *Polygonum*, a larkspur, two species of *Potentilla*, a *Geum*, *Senicio*, *Erigeron*, *Wyethia*, *Aster*, *Achillea*, *Caltha*, *Veratrum*, *Geranium*, two umbellifers, a *Silene* and an *Aralia*. Many additional species of plants have been noted in other localities and the hay often contains numerous dried flowers and some berries.

Nothing is known of the habits of these animals in winter when they and their haystacks are buried deep under the snow except that in spring the haystacks are found reduced to a few dry sticks and stems and the ochotonas seem to have survived the arctic winter in good condition.

While too small to be counted as game, these little animals serve a worthy purpose in add-

ing a feature of great interest to the upper slopes of the mountains.

In reply to a question, Mr. Bailey said the cony of the Bible was a *Hyrax*. Dr. Gill said the cony of old England was the rabbit and that the biblical scholars, mistakenly supposing the animal referred to was a rabbit, used the term cony in translating. The genus is now called *Procavia* instead of *Hyrax*. Both of the scientific names are also misapplications, the hyrax of the ancient Greeks being a shrew mouse and the biblical cony or daman being in no wise related to a *Cavia*. However, *Procavia* it must remain; the genus is the type of a very distinct family—Procaviidæ—as well as of a peculiar suborder.

M. C. MARSH,
Recording Secretary

THE ELISHA MITCHELL SOCIETY OF THE UNIVERSITY OF NORTH CAROLINA

THE 169th meeting was held in the main lecture room of Chemistry Hall, Tuesday January 15, 7:30 P.M., with the following program:

PROFESSOR H. V. WILSON: 'The Regenerative Power of Sponges.'

PROFESSOR J. W. GORE: (1) 'Direct Current Transmission of Power,' (2) 'The Electrical Aging of Flour.'

A. S. WHEELER,
Recording Secretary

DISCUSSION AND CORRESPONDENCE

THE GEOGRAPHIC BOARD OF CANADA

THE Geographic Board of Canada, organized in 1898 with aim, constitution and publications very like those of the older United States Board on Geographic Names, has just published its sixth report. As I have an interest in all matters pertaining to the geography of New Brunswick, I wish to make some comments upon the decisions of the board affecting that province.

The first duty for which the board was organized is to decide upon 'all questions concerning geographic names in the Dominion,' and its decisions up to the present are in the report before us. The great majority of these, so far as the province of New Brunswick is concerned, are admirable; but some of them, in my opinion, are quite indefensible. Thus, an important old English settlement in the province is called *Point de Bute*, sometimes printed *Pointe de Bute*. The board, called upon to decide between Point and Pointe, rejects the whole name and decides upon *Pont à Buot*, on the ground, as it has explained, that this is the original historic form of the name. Aside from the fact that this origin is only supposed and is not proved, the French form has not once been used since the English replaced the French in 1755; yet these English-speaking people are expected by the board to abandon their usage of a century and a half and adopt a form which is not only to them wholly new, but also very difficult to pronounce. Again, there is a small river and settlement which appear upon maps and in local newspapers, etc., variously as *Canouse*, *Canoos* and *Canoose*, the last being the commonest form and expressing exactly its local pronunciation. The board, called upon to choose between these forms, rejects them all, and decides upon an entirely new form, *Kanus*, explaining, in answer to inquiries, that this conforms to the Royal Geographical Society's rules for native names. Aside from the question as to the wisdom of changing century-old and locally-familiar words to newly-invented and strange ones to make them fit with a set of rules designed for a very different purpose, there is in this case the practical trouble that the board's form implies an erroneous pronunciation; for certainly most strangers, reading the form Kanus, would throw the accent on the first syllable and sound the a long, the exact reverse of local usage in both cases. Again, the board, very properly eliding the final possessive s in all cases of divided usage, extends this principle to cases where there is no local diversity. Thus an important bay and settlement are called *Maces Bay*, and a river and settlement are called *Cains River*, and those forms are locally invariable. Yet the board selects them for change and decides upon *Mace Bay* and *Cain River*, forms not only strange to New Brunswick ears, but, as they

sound to me, less euphonious and distinctive than the forms in use. Again, there are two important names, *Nepisiguit* and *Shippegan,* which the board decides must be spelled *Nipisiguit* and *Shippigan,* despite the fact that in both cases the former are in best accord with the history of the words, with the best maps, with the common local usage, and, as it seems to me, with a greater symmetry of construction of words. In fact in this case, while the board's forms can be found upon some maps, I can not find a single reason, even in theory, for their adoption in preference to the others. I can not take space to cite further examples, but these are the extreme cases of a number of similar sort.

The first thought of any geographer on reading these observations will be that the board has made these decisions in ignorance of local usage and will reconsider them when the facts are placed before it. Unfortunately, this supposition would not be correct. In the first place, the board has a New Brunswick representative to whom it can turn for local information; but I have in my possession evidence which shows that some at least of these decisions have not the approval of the New Brunswick representative. In the second place, when these decisions were announced by the board four years ago, they were fully discussed and the facts stated at length in a local newspaper, of which copies were sent the board, and to which indeed the board published a reply, though, in my opinion, an insufficient one. Further, within a year past, the facts were fully restated in a new communication sent through a prominent member of the board who agreed to, and doubtless did, lay it before the board. Since the new report affirms all the old decisions without change, we can only conclude that they represent the deliberate judgment of the board, and embody the methods which they propose to apply to Canadian geographical nomenclature. How different this position is from that of the United States board will be evident to every person concerned with geography. The United States board places convenience above all, adopts the best local usage, attempts no reforms upon theoretical grounds, and is steadily reducing confusion in the nomenclature of its territory. The Canadian board disregards local usage and convenience, attempts to reform nomenclature to accord with abstract principles, and is steadily increasing the confusion it was organized to lessen. It will be interesting to observe the comparative worth of the two methods in the geographical development of the future.

W. F. Ganong

Northampton, Mass.

Elimination vs. the First-Species Rule

Now that both sides of this controversy have presented their arguments, it appears desirable to briefly state the case and give a recital of the principal facts brought out by this discussion.

Briefly speaking, the point at issue is this: In every case where a new genus was founded on two species, neither of which was designated as the type, the advocates of the first-species rule claim that the first species cited or described under such genus is the *de facto* type, and can not become the type of any subsequently established genus. In opposition to this view the advocates of the elimination rule hold that in a case of this kind the action of a later author in selecting the first species as the type of a new genus is regular, and that the remaining species thereby becomes the type of the original genus. In case that the original genus contained three or more species and the later author selected any two of them to form a new genus, only one of them (the one that is the type of the new genus) is eliminated, and the remaining species may be designated the type of the original genus, or it may be subsequently selected as the type of a second new genus.

The advocates of the first-species rule claim for their method that it is the easier of the two and that it always leads to the same results, whereas the elimination method, by requiring a greater knowledge of the literature, is liable to lead to different results in the hands of different persons, according to whether they had consulted a greater or lesser number of publications on the subject.

The principles involved and facts estab-

lished in this discussion may be grouped as follows:

1. *The method of elimination is correct in principle.* Even the advocates of the first-species rule admit this. It therefore follows that, since these two methods are diametrically opposed to each other, one of them *must* be wrong. The inevitable conclusion, therefore, is reached that the advocates of the first-species rule are contending for a confessedly wrong principle.

2. *The method of elimination is in harmony with the law of priority* It upholds the action of the author who first took out the first species and made it the type of a new genus. In seeking to nullify such action the exponents of the first-species rule are proceeding in direct opposition to the law of priority —the basic law on which, more than on any other, the stability of our nomenclature confessedly depends.

3. *The principle of elimination is embodied in the majority of the codes of nomenclature from the very first.* The advocates of the first-species rule are, therefore, seeking to overthrow a principle that has long been authoritatively recognized and adopted.

4. *The difficulty in elimination is a decided benefit to science.* The subject of nomenclature is altogether too important to be entrusted to the amateur; only the seasoned scientist, who is thoroughly conversant with the literature of the subject, should ever attempt so important a matter.

5. *Elimination is as certain in its results as is the first-species rule.* With a perfected set of rules, any two trained scientists can be depended upon to arrive at the same conclusion in practically every case by the elimination method. The first-species method is not more certain, owing to the fact that in several cases the first species cited was incorrectly identified, and by accepting this name we should thereby be led into an error. Nothing short of an examination of the literature on the subject will secure correct results.

This is the gist of the whole matter. Now, I ask in all seriousness: Can any thoughtful person, having the best interests of science at heart, conscientiously advocate the adoption of the first-species rule—a rule that is admittedly wrong in principle, that is in direct opposition to the fundamental law of priority, that is also in opposition to the codes of nomenclature that have been officially adopted from the earliest times, and that is liable to lead to erroneous results?

D. W. COQUILLETT
U. S. NATIONAL MUSEUM,
January 29, 1907

THE U. S. GEOLOGICAL SURVEY

'THE good of the cause' must ever be held paramount in the estimation of every right-minded worker. It is for this reason alone, as I state from abundant knowledge, that many earnest students of American geology have refrained from going into print on matters of criticism affecting the U. S. Geological Survey. I should woefully regret the necessity of adopting Dr. Branner's conclusion as to the prime reason for the rule of silence among working geologists outside the survey. The best friends of the national organization have not publicly expressed opinions often privately uttered, simply because personal considerations have been held secondary to the progress of science. The field of American geology is so wide and the best possible achievements of one handicapped by other obligations is so limited, that the local investigator and the expeditionary observer learn to heartily welcome honest review of their own work by men better equipped with tools, duly qualified to gather the facts and not less capable of ratiocination, by reason of previous training, breadth of experience and ability to demonstrate and show cause for the conclusions given in their publications.

The recent unfortunate controversy illustrated by the letters of Messrs. Walcott, Branner and Hobbs in the columns of SCIENCE would be deplorable enough under any circumstances, and it might be passed without further remark were it not for several important facts and certain issues which ought not to be longer left in doubt.

1. The undisputed high standing of all these persons, and their many and valuable contributions to American geology, make it incon-

ceivable that the one in command, or either one of the others, could thus publicly discuss a matter involving mere personal issues.

2. The issues joined in the letters themselves do certainly raise questions affecting every American geologist, in or out of the survey, both in his professional capacity and in his relations to the survey as a citizen of the United States.

3. The scope and attitude of the U. S. Geological Survey in its field of work becomes of serious moment if the institution can be justly laid under suspicion of employing its prestige to throttle free discussion.

4. The internal adjustments of the survey as affects its personnel must always have interest to men of science, and it is not a trifling matter when several who have builded their life-work into its structure are compelled to leave it with words of protest.

5. The relation of the survey to other public (state) surveys is also a matter upon which American geologists have an undoubted right, if not a bounden duty, to express opinions freely.

6. The relation of the survey to sporadic workers and others closely concerns every fellow of the Geological Society of America and every geologist who has contributed his mite to the development of this branch of science.

7. The economic aspects of the national bureau and its industrial connections have given cause for more harsh criticism than any other features of its most versatile employment.

The director suggests that discussion can not serve a useful purpose. This is not the first, or second, or third time that this plea, urged by friends of the survey, including the writer, has been used to stem a more or less insistent spirit of adverse criticism. A number of times mild editorials have appeared which would have been followed by more drastic writing had not well-wishers of the survey (by no means its beneficiaries, some even who had suffered injustice from it) interfered successfully in its behalf. Nay more; for many years members of the survey staff have persistently ignored and, directly or by innuendo, thrown a veil of discredit over work previously done, without offering any evidence to offset it, but, on the contrary, confirming the earlier conclusions and taking the credit therefor. These are plain facts. Yet the sufferers thereby, patiently awaiting the vindication of time, have stood in the breach and fought for the honor of the survey—not for fear of any more harm from the same source, but because their devotion to eternal science transcended all personal and temporary considerations. I state these facts very reluctantly in the hope that the director and his staff may learn from them what useful purpose may be served by a plain, straightforward agitation of this whole question now. It can not harm the survey, but do it unspeakable good, if all be well with its heart and soul, as Mr. Walcott assures us is the case. But, with equal regard for Mr. Walcott, the names and work and characters of Branner and Hobbs and others are so cherished by American geologists that very strong proof must be adduced to convince them that they are now wholly in error.

It is because of the achievements of the survey corps under the present able director, that his most true friends have used their best endeavors to uphold and strengthen his hands in times of inimical attacks, and not always in accordance with the dictates of their own best judgment.

To be more explicit. It is very possible that the art of a politican is more effective in securing ample appropriations from congress than could be any amount of geologic ability. But may it not be equally true that a tithe of the amount thus obtained, if actually applied to geologic research, would accomplish much more in the legitimate field of geology than can now be so utilized?

The expansion of the geological survey to cover fields of questionable appropriateness has notoriously partaken of political claptrap, justified or palliated by the friends of the survey on the ground of expediency only. And the supreme test of this outside work is mainly yet to be applied. In those portions where the knowledge and experience of the practical geologist would appear to be most

essential, there has often been small provision for the searching preliminary investigations demanded by the situation. Studies of the mining fields are numerous, some excellent and thorough, but many have been entrusted to men of little experience, whose results are anything but satisfactory to those who try to use them in actual practise. Almost invariably these reports ignore the accessible but hardly wrought opinions of precedent workers who have successfully applied their observations in hundreds of instances. This method has become so clearly recognized as a 'geological survey habit' that one does not now expect otherwise. The survey has grown to such gigantic proportions that it can not much longer contain itself. It would be better to diminish its scope than to essay the suicidal rôle of autocrat of American science. With a better appreciation of the shortcomings of some of its own crew, whose hasty and superficial work has caused them to guess that they know more than they really have learned, it is probable that the national bureau would raise more enduring monuments than can be possible under existing methods. Studies of regional geology and monographic productions at the hands of the recognized leaders in geology have largely given place to *'omnium gatherum'* publications of temporary and chamber of commerce application.

In conclusion, it does appear to one friend of the survey that the value of the good will and well-deserved support of the ablest workers in geology is of more consequence than the ephemeral and illusive prestige which may enable the organization to ride rough shod over all as supreme arbiter. Such greed of power, if it really exists, as many have long suspected, can not be long concealed. And once it comes out in the open, its death-blow is self-inflicted. The real fear, that thing of which geologists derated by the survey are actually afraid, is that the just outcome of its energy and resources may not accrue to the legitimate ends in view in its original establishment. This question transcends personal considerations, and it certainly is involved to some extent in the recently published discussion which is the text for this communication.

THEO. B. COMSTOCK

LOS ANGELES, CAL.,
January 12, 1907

SPECIAL ARTICLES

VARIATION IN MOSQUITO HABITS

DURING the summer of 1906, a more systematic series of observations was made on the salt-marsh area near the city of Elizabeth, New Jersey, partly to determine the number of broods, partly to ascertain the relative proportion of *C. cantator* and *C. sollicitans,* and partly to learn more of their migrations.

Generally speaking, we knew that the number of broods varied with the season, and that it was largely a matter of tides and storms as to how many there would be. We knew also that in the southern part of New Jersey *C. sollicitans* was the dominant species, *C. cantator* forming only a small minority early in the season, and that *cantator* was dominant in the northern section at least during the early part of the summer. Concerning the migrations we knew that they occurred; but just how long they were continued and how far they extended was yet a question.

As early as April 19 there was a full brood of larvæ in the pools and these matured before the end of the month. It formed brood I. of the season, was almost all *cantator,* and the adults left the meadow soon after hatching and traveled inland along the valleys of the Rahway and Elizabeth Rivers. On May 2 they were met with in great numbers at Millburn and covered the entire territory between that and the marsh, a distance of about twelve miles in a direct line. This migration was not followed from the marsh directly.

The II. brood was in the pools, already well grown May 10 and reached the adult stage May 15, 80 per cent. *cantator,* 20 per cent. *sollicitans.* It was also a large brood, left the meadow promptly in large proportion, and was followed through the Elizabeth Valley to Elizabeth, Aldene, Salem, Union, Springfield and Maplewood. It also extended all along the first ridge of the Orange Mountains and reached Summit, a distance of fifteen miles

from their place of birth. Just how far beyond that individuals traveled we could not determine, but as that country is hilly they got no further in swarms. Specimens in numbers are recorded from Madison, however, from a previous year's collection.

June 1, while brood III. was in the early larval stage and all the migrants had left the marsh, one of my assistants spent the night on it with instructions to capture and record every specimen that alighted on him or attempted to bite. The record is as follows:

Between the Hours	Cantator	Sollicitans
5– 6 P.M.	16	9
6– 7 "	23	19
7– 8 "	30	27
8– 9 "	13	14
9–10 "	5	7
10–11 "	1	1
11–12 "	2	0
12– 1 A.M.	1	0
1– 2 "	2	0
2– 3 "	0	2
3– 4 "	1	3
4– 5 "	14	20
5– 6 "	22	46
	130	148

It appears, therefore, that as between the two, *sollicitans* seems to have a period of rest during the middle of the night, but is much more active than *cantator,* especially in the morning hours. And the proportion is greater than shown by the figures, because the actual number of *cantator* on the meadow was as about 8 to 2 of *sollicitans.*

The advance guard of brood III. emerged from the pools June 10 and then came a series of high tides that brought killifish everywhere on the meadow and simply swept what remained out of existence. The survivals were 70 per cent. *cantator* to 30 per cent. *sollicitans* and none of these extended inland further than Short Hills, a distance of about ten miles from the marsh.

Brood number IV. was in the pools June 24, and on the wing July 3. It was a small brood, almost evenly divided between the two species, and the flights extended to Short Hills July 14 and probably to Summit as well; this latter record based upon specimens sent in at the time.

Brood V. came to maturity between July 23 and 28, consisted of 80 per cent. *cantator* and did not get beyond Irvington, about five miles away. It was small in numbers.

Brood VI. was a very large one which reached the adult stage August 13, 85 per cent. *sollicitans* to 15 per cent. *cantator.* It was the first brood in which *sollicitans* was dominant and it left the meadows almost immediately. A day after they began to emerge the highlands approaching the marsh were swarming with adults while the marsh itself was comparatively free. This brood traveled almost due west and supplied the heaviest swarm of the season for Summit and intervening places. Fully 90 per cent. of this brood left the meadow.

Brood VII. matured August 31 and was a small one, 65 per cent. *sollicitans,* 35 per cent. *cantator.* Contrary to the one before, this was a stay-at-home brood; not 10 per cent. left the meadows and none got much if any beyond North Elizabeth, only a mile or two from the marsh.

Brood VIII. was on the wing September 18, 70 per cent. *sollicitans,* and was also a stay-at-home. It was also a small one and did not get much beyond the immediately surrounding highlands.

Brood IX. was on the wing October 2, also small in size, 90 per cent. *sollicitans* and not a migrant.

Brood X. was in the pools October 12, largely *sollicitans* and most of them fell victims to fish carried up over the meadows by the early fall tides. Very few adults were observed later and there was no migration. After this breeding was irregular and while larvæ of *cantator* were found as late as November 30, it is perhaps questionable whether any of the insects reached the egg-laying condition.

The interesting point here is the difference between the broods in their tendency to migrate. The early broods always migrate freely as far as my observations extend, and whenever meadow conditions are favorable, the first

days of May find a cloud of marsh mosquitoes sweeping inland.

As the marshes are usually waterlogged in early spring and every pool clean up to the highland holds water, the hibernating eggs hatch in large proportion and the broods are large.

An interesting question arises here. The migrants are almost exclusively sterile females: the eggs from which many of them hatch have been on the marsh from early the year before, ready to hatch when opportunity offered. Is there any relation between the age of the egg and the sterility of the females resulting from them? The matter will not be easy to demonstrate because of the difficulty of securing pairings in confinement.

JOHN B. SMITH

COLOR INHERITANCE IN MAMMALS

PROFESSOR CASTLE'S interesting article in SCIENCE of January 25 clears up an important point, and renders it possible to explain certain phases of color inheritance in swine and in cattle. For the most part, his factor A, which determines the arrangement of pigment giving the agouti color, seems to be wanting in these two classes of domesticated animals. Perhaps it has been lost. It seems to be present in the wild boar of Europe, which has been used in breeding experiment by Mr. Q. I. Simpson, whose work has furnished important data for the elucidation of color inheritance in swine. In a few instances there is a tendency in certain breeds of swine for red pigment to predominate near the extremities of hairs; in the Berkshire breed occasional individuals show this tendency, and I have seen the same in crosses between this breed and Hampshires. The tendency is never well marked, so that in these animals the function A is presumably present in a weakened condition.

For the most part black and red in swine and cattle evidently behave just as they do in guinea-pigs. Aberdeen-Angus (black) cattle crossed on Herefords (red and white) give blacks. The heterozygotes bred back to Herefords give blacks and reds in approximately equal numbers. In swine, red and black each appear to present more than one type, and the various reds and blacks do not behave quite the same. Tamworths, a red breed of swine, present at least two distinguishable forms of red, namely, light red and dark red. The light becomes lighter with age, and the dark darker. Light is also dominant to dark. When light red is crossed on Chester white the progeny is red roan. Dark red crossed on Chester white gives clear white.

Most black breeds of swine, when crossed with Tamworths or Duroc-Jersey (both red), give black and red spotted, but Hampshires (black with white belt) crossed with red give the Hampshire coloring. This shows that Hampshire black and Berkshire black differ.

It is highly significant that the same color factors should exist (apparently) in guinea-pigs, rats, mice, rabbits, swine and cattle. This fact may be of great service in breeding fixed color types in farm animals.

Professor Castle's clear explanation of color types in Guinea pigs will doubtless aid greatly in comprehending the data on color inheritance in swine which the committee on animal hybrids is collecting for the American Breeders Association.

The object of this communication is not, however, to call attention to the parallel in color factors in different classes of mammals, for there is not at hand sufficient data to demonstrate a complete parallel. It is rather to call attention to a simple method of expressing the allelomorphic constitution of organisms, and one which renders it easy, when this constitution is known, to display the necessary results of a given line of breeding. We may use Professor Castle's data in illustrating the method.

The allelomorphic formula of a homozygous individual may be represented by AA, BB, CC, etc. The gametes produced by such an individual would be ABC, etc. Letting G stand for the factor which determines the agouti color, Bl for black, and R for red pigment, and letting A stand for the absence of G, B for the absence of Bl, and C for the absence of R, the formulæ for the several types of color discussed by Professor Castle would be:

(1) Agouti,	GG, BlBl, RR,	producing gametes	G Bl R
(2) Black,	AA, BlBl, RR,	" "	A Bl R
(3) Red,	AA, BB, RR,	" "	A B R
(4) Red,	GG, BB, RR,	" "	G B R

The cross between (2) and (3) gives AA, BlB, RR, which is black. The gametes produced by this hybrid are ABlR and ABR. The fortuitous union of these gives, in generation F_2:

1 AA, BlBl, RR; 2 AA, BlB, RR; 1 AABBRR,
or 3 black and 1 red.

The cross between (2) and (4) gives AG, BlB, RR (agouti), producing gametes ABlR, ABR, GBlR, GBR. The fortuitous union of these gives:

(*a*) 1 AA, BlBl, RR; (*d*) 2 AG, BlBl, RR; (*g*) 1 GG, BlBl, RR;;
(*b*) 2 AA, BlB, RR; (*e*) 4 AG, BlB, RR; (*h*) 2 GG, BlB, RR;
(*c*) 1 AA, BB, RR; (*f*) 2 AG, BB, RR; (*i*) 1 GG, BB, RR

or

1 Black	2 Agouti	1 Agouti
2 "	4 "	2 "
1 Red	2 Red	1 Red.

This gives 9 agouti, 4 red, and 3 black.

If the cross (2) $\times$ (4) (= AG, BlB, RR), is crossed with (3) (AA, BB, RR) we get:

Gametes of (2) x (4)		Gametes of (3)
ABlR	x	ABR = AA, BlB, RR (black)
ABR	x	ABR = AA, BB, RR (red)
GBlR	x	ABR = GA, BlB, RR (agouti)
GBR	x	ABR = GA, BB, RR (red),

or 2 reds, 1 black, and 1 agouti. Professor Castle states that 4 types of reversionary agoutis probably occur in the cross (2) $\times$ (4), 3 of which have been obtained in his experiments. Table I. above, giving generation F_2 of this cross, shows that the type (*e*) (AG, BlB, RR) occurs in four sixteenths of this generation, type (*h*) (GG, BlB, RR) in two sixteenths, and type (*d*) (AG, BlBl, RR) in two sixteenths. These are the three types he found in his experiments. The fourth type, (*g*) (GG, BlBl, RR) occurs in only one sixteenth of this generation. The small number of individuals in which this type occurs doubtless accounts for the fact that it has not yet been found in the experiments.

From the formulæ of these four types we readily see why they behave as stated by Professor Castle. Type (*e*) is the same as the cross (2) $\times$ (4), and therefore gives, in generation F_2, 9 agoutis, 4 reds, and 3 blacks; (*h*) produces gametes GBlB and GBR. These uniting with ABR (red) give half AG, BlB, RR (agouti) and half AG, BB, RR (red); (*d*) produces gametes ABlR and GBlR. These uniting with ABR (red) give half AA, BlB, RR (black) and half AG, BlB, RR (agouti). The remaining type (*g*) is pure agouti, and breeds true.

The above formulæ may seem complex at first, but they are really quite simple, and render the process of determining the character content of any cross and its progeny exceedingly easy.

One of the above crosses shows how two characters that are not allelomorphic to each other may still give the numerical relations in generation F_2 of a pair of allelomorphs. An individual having the color black may have the formula BlBl, RR, the red not being noticeable because indiscriminately mixed with, and concealed by, the black pigment. A red individual may have the formula AA, RR, in which A represents the absence of Bl. The respective gametes are BlR and AR; the hybrid being ABl, RR, which is black. The gametes produced by this hybrid are AR and BlR. Fortuitous union of these gives:

AR x AR = AA, RR (red)
AR x BlR = ABl, RR
BlR x AR = ABl, RR } (black-hybrids)
BlR x BlR = BlBl, RR (black-pure)

This is clearly the same result, as far as color of progeny is concerned, as if Bl and R were a pair of allelomorphs. We know they are not, since in the pure agouti type both colors are present in such form as to be transmitted to all the progeny.

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NOTES ON ORGANIC CHEMISTRY

DIAZOAMINOMETHANE (DIMETHYLTRIAZINE)

Many members of the important class of compounds known as the diazoamino derivatives are known, but these, hitherto, have all belonged to the aromatic series. Otto Dimroth[1] has, however, recently succeeded in isolating the first and lowest representative of the aliphatic division—*diazoaminomethane* or *dimethyltriazine,* as it may also be called, $CH_3N:NNHCH_3$. The compound is interesting not only for the reasons given, but also on

[1] *Ber. d. Chem. Ges.*, **39**, 3905 (1906).

account of its peculiar properties, which rendered its isolation and investigation a matter of extreme difficulty.

Sodium azoimide, NaN_3, when treated with dimethyl sulphate, yields methylazide,

$$CH_3N<\overset{N}{\underset{N}{\vdots}},$$

and this, by the action of methylmagnesium iodide (Grignard's reagent) and water gives diazoaminomethane, which is a colorless liquid, melting at $-12°$. It is extremely reactive and is decomposed during the course of its preparation by the catalytic action of the small quantity of impurity usually present in magnesium. It boils at 92°, but promptly decomposes, volatilizes readily at the ordinary temperature, more rapidly at the boiling point of ether and is miscible in all proportions with every solvent. Acids convert it instantly into nitrogen, methylamine and the methyl ester of the acid. In dilute solution it has a sweet taste, but the pure compound rapidly cauterizes and blisters the skin, and its vapor, when inhaled, produces severe headache accompanied by a prolonged feeling of lassitude. Diazoaminomethane forms a *silver salt*, $CH_3N:NN(Ag)CH_3$, and a *cuprous salt*, $CH_3N:NN(Cu)CH_3$, the latter crystallizing in large, lustrous, yellow prisms. It is by means of this compound that the separation and final purification of the diazoaminomethane was effected.

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CURRENT NOTES ON METEOROLOGY

MOISTURE FROM CLOUDS

SOME interesting observations have lately been made by Marloth on the amount of moisture deposited by the S. E. trade clouds on vegetation growing on the summit of Table Mountain, South Africa (*Trans. So. Afr. Phil. Soc.*, XIV., Pt. 4, Oct., 1903; XVI., Pt. 2, Oct., 1905; *Met. Zeitschr.*, Dec., 1906). In this southwestern extremity of South Africa the winter is rainy and the summer dry. About three quarters of the annual precipitation falls in the six winter months, and in the three summer months (Dec.–Feb.) only about eight per cent., 2.16 inches, falls on the average. It occasionally happens that two months may pass without a drop of rain. The vegetation on the hills and on the lower slopes of the mountains clearly reflects the deficiency of summer precipitation, but on the mountains vegetation is much more abundant, and shows much more favorable conditions of moisture supply. The latter has been shown by Marloth to come from the clouds formed over the mountains in the S. E. trade wind. The plants collect the cloud drops in sufficient quantity, not only to keep themselves wet, but even to furnish enough water to produce a permanent swamp on the top of Table Mountain in winter, and a periodic swamp in summer. The summer swamp dries up during long spells of clear weather, but appears again when the S. E. cloud is formed. Small ponds actually form, sometimes even in late summer, on the top of Table Mountain. A photograph of a pond appears in Marloth's report. An interesting piece of evidence as to the effect of the water thus collected by vegetation is given in the note that in the case of a mountain stream in this region, which can furnish sixty horse-power, three days after a fire which burned off the bushes and grass at the head of this stream, the water furnished only twenty horse-power. The cloud on Table Mountain is a mixture of an ordinary cloud and very finely distributed rain-drops in process of formation. The whole mass moves at high velocity (the trade velocity is there often forty miles an hour), which prevents the fall of small drops. It is not until they come in contact with a solid object, and when the velocity is reduced, that the drops are held by the obstacle, and gradually reach the ground.

In connection with this phenomenon reference may be made to various suggestions that have been brought forward regarding the possible utilization of fog for the uses of vegetation in California (*Mo. Wea. Rev.*, Oct., 1898, 466; 1899, 301, 473); also to Hann's 'Handbook of Climatology' (English translation), 195–196.

MONTHLY WEATHER REVIEW

The October, 1906, number of the *Monthly Weather Review* (dated Jan. 4, 1907) contains the following papers of general interest: 'A Rare Cumulus Cloud of Lenticular Shape,' by H. H. Clayton; illustrated by three half-tone views, and accompanied by comments on similar clouds by Professor Abbe. 'Monthly Review of the Progress of Climatology throughout the World,' by C. F. Talman; notes on meteorological stations in Iceland, and on the climates of British East Africa, the Solomon Islands and of Sistan. 'Sonora Storms and Sonora Clouds of California,' by Archibald Campbell, with a weather map showing the conditions which prevail during a Sonora cloud period, and a half-tone picture of one of these clouds. 'Has the Gulf Stream any Influence on the Weather of New York City?' by James Page, of the Weather Bureau. This is a brief discussion which we hope may find its way very generally into the daily press, and set right the many erroneous ideas which are prevalent on this question. Professor F. H. Bigelow continues his study of the meteorological conditions of the Cottage City waterspout of 1896 with a highly mathematical paper.

ALTITUDE AND PNEUMONIA

Dr. Isaac W. Brewer, of Fort Huachuca, Ariz., after studying the medical statistics of the army concludes (1) that altitude has nothing to do with the mortality from lobar pneumonia; (2) that latitude within the range afforded by the territory of the United States has nothing to do with the mortality; (3) that the mortality among the colored troops is about twice as great as among the white soldiers (*So. Cal. Practitioner,* Dec., 1906).

THE FRENCH SAHARA

The meteorological observations made in the French Sahara by the *Mission Saharienne* (*Mission Foureau-Lamy d'Alger au Congo par le Tchad,* Pts. I. and II., pp. 551, Paris, Masson) are welcome as throwing light on the climate of a region concerning which but little is known. The temperature fell below freezing twenty-five times. The maximum was 119°. The minimum temperature was recorded about 5 A.M.; the maximum between 1 and 2 P.M. Dew was observed on fourteen occasions. There was rain on 116 days (out of 645). In the Aïr highlands thunder and lightning were noted almost every afternoon.

R. DeC. Ward

Harvard University

WILLIAM WELLS NEWELL

William Wells Newell, the founder of the American Folk-Lore Society, died at his summer home in Wayland on January 21st, 1907, at the age of sixty-eight.

The broad culture of Mr. Newell and his extended interest in many branches of literature and science made his name known throughout the country. Those best acquainted with him were often amazed at the accurate knowledge and the sincere appreciation of subjects widely diverse in interest. He was especially gifted as a student of folk-lore and comparative literature and as a classical scholar, a linguist and a craftsman. Mr. Newell made a special study of the Arthurian myth and his collection of tales, 'King Arthur and the Round Table,' published in 1897, showed deep research and an intimate knowledge of the literature of the time. His translation of Sophocles's 'Œdipus Tyrannus' reveal him as a student of the classics. 'Words for Music,' a little volume of verse, most of which was original, contains charming bits of a more or less personal nature which show Mr. Newell as his intimate friends knew him, lovable, kindly and appreciative of all that was good. The book itself is an example of Mr. Newell's abilities as a craftsman. It was printed upon his private press at Hazelbrook, Wayland, and is an example of typographical excellency.

It is, however, the cause of American Folk-Lore that has suffered most in the death of Mr. Newell. It has lost its most enthusiastic worker and devoted friend. The American Folk-Lore Society was his from the very beginning, and it was owing to his untiring energies that the *Journal of American Folk-Lore* was started and has since been successfully carried on.

His death has left a void in the lives of many and has deprived the cause of culture of a strong supporter. A. M. T.

SCIENTIFIC NOTES AND NEWS

BY the will of M. Daniel Osiris, the Pasteur Institute of Paris receives an additional endowment of $5,000,000. It is said that the institute will establish branches for scientific research in various places in France and the French colonies.

THE Berlin Academy of Sciences has elected to membership Dr. Johannes Orth, professor of pathological anatomy; Dr. Max Rubner, professor of hygiene, and Dr. Albrecht Penck, professor of geography, all of the University of Berlin.

As has been already announced, the buildings of the Carnegie Institute, Pittsburg, will be dedicated on April 11, 12 and 13. A number of distinguished foreigners will be present, including among men of science: Sir Robert Ball, professor of astronomy, Cambridge University; Mr. Guglielmo Marconi; Dr. P. Chalmers Mitchell, secretary of the London Zoological Society; Sir William Henry Preece, electrical engineer; Sir William Turner, principal of Edinburgh University; M. Marcellin Boule, director of the Paris Museum of Natural History, and Professor Friedrich S. Archenhold, director of the Treptow Observatory.

SIR CHARLES TODD, F.R.S., director of the Astronomical and Meteorological Observatory of South Australia, has retired, having reached the age of eighty years. He was, until last year, also postmaster general and superintendent of telegraphs. Sir Charles is succeeded in the directorship of the observatory by Mr. F. Griffith.

AT a meeting of the Nebraska Academy of Medicine, held in Lincoln on January 10, a committee of five, consisting of Drs. Solon R. Towne, Alexander S. von Mansfelde, Henry B. Ward, Robert H. Wolcott and H. Winnett Orr, was appointed to make an effort to obtain the Nobel prize for Dr. James Carroll, U. S. Army.

DR. N. L. BRITTON, director of the New York Botanical Garden, accompanied by Mrs. Britton and Dr. Charles F. Millspaugh, curator of botany in the Field Museum of Natural History, have gone to Nassau, where a schooner will be chartered for a cruise among the smaller islands of the Bahamian group. This is Dr. Britton's fourth trip to the Bahamas, and it is understood that a volume on their flora will be published by him in connection with Dr. Millspaugh.

AT the Leicester meeting of the British Association the evening lectures will be by Mr. W. Duddell, on 'The Arc and the Spark in Radio-telegraphy,' and by Dr. F. A. Dixey, on 'Recent Developments in the Theory of Mimicry.' The lecture to the operative classes will be given by Professor H. A. Miers, F.R.S., on 'The Growth of a Crystal.'

LORD AVEBURY has been elected president of the Royal Microscopical Society.

AT the annual meeting of the London Entomological Society, on January 23, the retiring president, Mr. F. Merrifield, made the address. Mr. C. O. Waterhouse was elected president for the ensuing year.

PROFESSOR A. LAWRENCE LOWELL, who holds the chair of the science of government at Harvard University, has been selected to be the special Harvard lecturer at Yale University for 1907. This lectureship, as will be remembered, was founded in 1905 by the gift of $10,000 from an anonymous Harvard graduate; the income of the fund to be used in securing members of the Harvard faculty to give lectures at Yale.

DR. DAVID P. BARROWS, director of the Bureau of Education of the Philippine Islands, gave a lecture on 'Mohammedanism in the Philippine Islands' before the California branch of the American Folk-lore Society on February 7.

THE ninth lecture in the Harvey Society Course will be delivered by Professor W. T. Councilman, professor of pathology, Harvard University, at the New York Academy of Medicine, on Saturday, February 23 at 8:30 P.M. Subject: 'The Relation of Certain

Leucocytes to Infectious Diseases.' All interested are cordially invited to be present.

The Portuguese members of the Fifteenth International Medical Congress, held in April last, have presented Professor Miguel Bombarda with a gold medal and an address expressing their appreciation of his services as organizing secretary of the congress.

The Emperor of Austria has conferred on Duke Karl Theodor, of Bavaria, the Order for Art and Science in recognition of his distinction as an ophthalmologist.

The British Academy has received the sum of £10,000 for the purpose of establishing a memorial to the late Mr. Leopold Schweich of Paris. In accordance with the wishes of the donor, the endowment is to be called 'The Leopold Schweich Fund,' and is to be devoted to the furtherance of research in the archeology, art, history, languages, and literature of ancient civilization, with reference to Biblical study.

Professor Thomas Condon, who held the chair of geology in the University of Oregon, died on February 11, at the age of seventy-five years.

Mr. William Simms, senior fellow of the Royal Astronomical Society, died on January the second in his ninetieth year.

Mr. E. B. McClellan, third assistant at the Radcliffe Observatory, Oxford, died on January 2, at the age of forty-five years.

Mr. F. P. H. Stirling, professor of mathematics in the Christian College at Madras, has died at the early age of twenty-six years.

The death is announced of Professor Pierre Budin, of Paris, known for his work on obstetrics and the hygiene of infancy.

We regret also to learn of the death of Dr. Clement Schlueter, who not long ago retired from the professorship of geology at Bonn University. Professor Schlueter was a paleontologist who had devoted much attention to the cretaceous fossils of north Germany, particularly to the Echinoidea. His work on them was distinguished by learning, care and accuracy.

There will, on March 5, be civil service examinations for geologists in the Philippine service, at a salary of $2,000, and for irrigation manager in the Office of Experiment Stations, of which there are five vacancies, at salaries of from $1,800 to $2,500.

The National Educational Association will hold its fiftieth anniversary meeting at Los Angeles from July 8 to 12. It was originally intended to hold this meeting in Philadelphia, where the association was organized in 1857, but the railways would not grant the usual terms, by which the membership fee is collected with the ticket and return privileges granted until September 1. Dr. Nathan C. Schaeffer, superintendent for Pennsylvania, is president of the association.

The fourteenth International Congress of Hygiene and Demography will be held at Berlin from September 23 to 29. Communications relative to the congress should be addressed to the general secretary, Dr. Nietner, Eichhornstrasse 9, Berlin, 9 W.

The seventh International Congress of Physiology will be held this year at Heidelberg from August 13 to 16, under the presidency of Professor August Kossel. In connection with the congress there will be an exhibition of scientific apparatus. Announcements of communications should be sent to the Physiological Institute, Heidelberg, before June 15.

An International Congress for Psychiatry, Neurology and the Care of the Insane is being organized under the auspices of the Dutch Society of Psychiatry and Neurology, to be held at Amsterdam from the second to the ninth of September of the present year. Those who have been invited to be American members of the committee of arrangements are: G. Alden Blumer, Providence; Charles K. Mills, John K. Mitchell and S. Weir Mitchell, of Philadelphia, and R. G. Rabinovitch, of New York City.

We learn from the *Journal of the American Medical Association* that the universities at Heidelberg, Berlin and Tübingen have each received 10,000 Marks from the estate of the

late eminent ophthalmologist, Herman Cohn, of Breslau. The income from each endowment is to be awarded as a prize for research in ophthalmology.

THE Wisconsin Archeological Society has secured an option on and will purchase the remarkable man mound near Baraboa and thus make it accessible to the public. The money necessary to its purchase will be raised by popular subscription.

AT a meeting held on January 29 at the residence of M. Beernaert, Minister of State, it was decided to organize a new Belgian South Polar expedition. It is also announced that a new British expedition to the South Polar regions will leave England next October under the command of E. H. Schackleton, who was third lieutenant on the *Discovery* expedition.

WE learn from *Nature* that an Association for the Promotion of Flight is in course of formation. The association will aim at assisting inventors and investigators to carry out experiments in artificial flight. In order to secure that no funds shall be subscribed by speculators with any hope of return, it is proposed that, in the case of its ultimate success in its object, the valuable assets, such as a facility for constructing practicable flight machines, should be handed, free of cost, to the nation. A provisional committee has been appointed, which includes the Hon. C. A. Parsons, F.R.S., Sir William Crookes, F.R.S., Major B. F. S. Baden-Powell and others.

THE Prussian government has authorized the organization of a lottery for the benefit of Gen. Count Zeppelin's further experiments in airship building.

THE Rothamsted Experimental Station in Hertfordshire has received a gift of £2,000 from the Permanent Nitrate Committee.

REUTER'S AGENCY is informed that Major Powell Cotton has sent home a complete skeleton of an okapi, the skull of which is said to be probably one of the most remarkable specimens ever brought to this country. In addition, there is a beautifully marked and perfect skin in a better condition than that now in the national collection. Major Powell Cotton has also sent to England the skin of a young okapi. All are now at the British Museum.

UNIVERSITY AND EDUCATIONAL NEWS

THE appellate division of the Supreme Court has decided that the will of the late Wallace Andrews of New York City, bequeathing more than $1,500,000 for a school for girls at Willoughby, Ohio, is valid. The money was to go to the Smithsonian Institution in case the bequest for the school was invalid.

MR. A. MCCHARLES has bequeathed $10,000 to the University of Toronto, to establish prizes for scientific discoveries.

SIR COWASJEE JEHANGHIR READYMONEY has offered to the Bombay government the sum of $80,000 for the erection of a university examination hall in Bombay, thus following the example of his father in giving to the city the Elphinstone College buildings and the Senate-hall of the university.

MR. W. F. STANLEY, of the firm of optical and scientific instrument makers, has built and endowed a new trade technical school at South Norwood Hill, for 400 boys, at a cost of some $250,000.

THE late Dr. John Wight has left £3,000 to Aberdeen University to found four or more medical bursaries.

WE learn from *The British Medical Journal* that Dr. Schorstein, whose early death deprived the London Hospital of one of the ablest members of its medical staff, has bequeathed £500 to that hospital. He has also bequeathed £500 to the regius professor of medicine at Oxford, and the residue of his estate to the university chest at Oxford, subject to trusts to pay the income to his mother and sister for their lives, with ultimate remainder for such purposes as the Hebdomadal Council may decide. He expressed the hope that the bequest would be used for something in connection with the medical school at Oxford. The Oxford medical school will probably eventually benefit by a capital sum of between seven and eight thousand pounds.

MEDICAL journals note the beginning of a movement to establish a university in Frank-

fort. Rich citizens are said to have collected funds for the purpose, but since the creation of universities belongs exclusively to the state and not, as in America, to private initiative, the funds will be given to the government if it approves of the objects of the contributors. Frankfort has for a long time possessed the nucleus of a medical faculty; the old Senckenberg Institute, founded by a wealthy citizen, contains a number of well-furnished chemical, physical, anatomical and other laboratories; the Royal Institution for Experimental Therapy under the direction of Professor Ehrlich attracts every year a great many graduates from other parts of Germany and from abroad; the hospitals of Frankfort are of the first rank, and contain an immense amount of clinical material which has not hitherto been used for teaching purposes. The establishment of a university will, therefore, be easy, so far as the medical faculty is concerned. No new universities have been founded in Germany for about a century, except at Strasburg, where the old university existing previously to the French occupation was reestablished in 1872.

A DEPARTMENT of forestry, professional in character, has, as we have already noted, been organized at the Pennsylvania State College, the first registrations having been made for the spring session of 1907. The department is organically arranged in the School of Agriculture, the studies of the first year being in common. An announcement by Dr. B. E. Fernow, professor of forestry, says: "The profession of forestry, although practised in Europe for more than a century and a half, is quite new in this country, the first professional school having been established less than a decade ago, yet the need of foresters has grown more rapidly than the several schools which followed the first have been able to provide. At present the largest demand is made by the federal forest service, but the various states, and especially the state of Pennsylvania, as well as private owners and corporations, are bound to call for the services of fully equipped foresters in large numbers, as the needs and advantages of a better treatment of our woodlands becomes recognized. The state of Pennsylvania has set aside state forest reservations to the extent of nearly one million acres, and adds annually more. It is only fair to assume that graduates of the Pennsylvania State College must ultimately find a field of usefulness in their management."

THE Hungarian government is said to have under consideration the foundation of a new university at Pressburg. The existing universities of Hungary are those of Buda Pesth and Klausenburg.

THE Senate of London University have accepted an invitation from the University of Paris to send eighty representatives of the university to visit Paris.

THE University of Virginia will this year conduct a summer school.

THE classes for workingmen of New Haven, inaugurated by the Sheffield Scientific School, held their first session on January 17. Over 150 men appeared at the first classes, overflowing the rooms originally assigned.

A PRINCIPAL is to be chosen in March for the Dunn County School of Agriculture. The salary is $2,000. Candidates are to write to the present principal, Dr. F. C. Davis, Menomonie, Wis. The school is said to be the first of its kind to be established in America, and has made a valuable place for itself by the instruction of the young men and women of the vicinity along agricultural and other economic lines. Also by carrying on some twenty-five lines of useful work for farmers, such as testing cows for butter fat—testing herds for tuberculosis, etc., and by holding many farmers' institutes each year. Dr. Davis leaves the place in June to become dean of the new state school of agriculture at Canton, N. Y.

DR. JOHN W. HARSHBERGER has been promoted to be assistant professor of botany in the University of Pennsylvania.

PROFESSOR KUENEN has resigned the Harris chair of physics in University College, Dundee, and accepted the new chair of physical chemistry in the University of Leyden.